DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
INTEGRATED PRODUCT TEAM WEST
2001 JUNIPERO SERRA BOULEVARD, SUITE 600
DALY CITY, CALIFORNIA 94014-1976

IN REPLY REFER TO:

Ser 05/307
January 17, 2005

Mr. Phillip A. Ramsey
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Re: FINAL LANDFILL GAS SAMPLING AND ANALYSIS PLAN, SITE 1 TIDAL AREA LANDFILL, NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD, CONCORD, CALIFORNIA

Dear Mr. Ramsey,

In accordance with Sections 10.2 (b) and 10.7 (e) of the Federal Facility Agreement (FFA), enclosed please find for your information the "Final Landfill Gas Sampling and Analysis Plan, Site 1 Tidal Area Landfill, Naval Weapons Station Seal Beach, Detachment Concord, Concord, California." The comments received by the Navy on the draft version of this Secondary document (dated September 22, 2004) are included as an Appendix along with the Navy's responses.

2. If there are any questions regarding the enclosed plan, please contact me at telephone No. 650-746-7451 or Internet e-mail: stephen.f.tyahla@navy.mil.

Sincerely,

Stephen F. Tyahla, P.E., CHMM
Lead Remedial Project Manager

Enclosure
Copy to:
California Department of Toxic Substances Control, Region 1 (Attn: James Pinasco)
California Regional Water Quality Control Board, SFBAY (Attn: Laurent Meillier)
Contra Costa County Environmental Health, LEA (Attn: Agnes T. Vinluan)
Cal/EPA Integrated Waste Management Board Permitting & Enforcement Division (Attn: Frank Davies)
Tech Law, Inc. (Attn: Jennifer Hollingsworth)

Re: FINAL LANDFILL GAS SAMPLING AND ANALYSIS PLAN, SITE 1 TIDAL AREA LANDFILL, NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD, CONCORD, CALIFORNIA

Copy to (continued):
Restoration Advisory Board (RAB) Co-Chair (Attn: Ms. Mary Lou Williams)
RAB Member Chris Boyer
RAB Member Kevin Cornish
RAB Member David Griffith
RAB Member Gregory Glaser
RAB Member Ed McGee
RAB Member Mario Menesini
RAB Member Julie Nelson
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NWS Seal Beach, N09WS (Attn: Gregg Smith)
TtEMI San Francisco (Attn: Joanna Canepa)
TtEMI (Attn: John Bosche)

GENERAL SERVICES ADMINISTRATION
CONTRACT NUMBER GS-10F-0076K
DELIVERY ORDER NUMBER 62474-03-F-4023

Landfill Gas Sampling and Analysis Plan (Field Sampling Plan/Quality Assurance Project Plan) Site 1 Tidal Area Landfill

Naval Weapons Station Seal Beach Detachment Concord
Concord, California

GSA.032.013

FINAL

January 17, 2005

Department of the Navy
Integrated Product Team, West
Daly City, California

TETRA TECH, INC.

GENERAL SERVICES ADMINISTRATION
Contract Number: GS-10F-0076K
Delivery Order: N62474-01-F-6036

Final

Landfill Gas Sampling and Analysis Plan

(Field Sampling Plan/Quality Assurance Project Plan)

Site 1 Tidal Area Landfill

Naval Weapons Station Seal Beach Detachment Concord
Concord, California

January 17, 2005

Prepared for

NAVFAC
Naval Facilities Engineering Command

DEPARTMENT OF THE NAVY
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Prepared by

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John Bosche, P.E., Project Manager

DS.032.013

Final

Landfill Gas Sampling and Analysis Plan
(Field Sampling Plan/Quality Assurance Project Plan)
Site 1 Tidal Area Landfill
Naval Weapons Station Seal Beach Detachment Concord
Concord, California

Contract Number: GS-10F-0076K
Delivery Order: N62474-01-F-6036

PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Tetra Tech Program

QA Manager: Kevin Hoch For Date: *01/10/05*
Greg Swanson, Tetra Tech

Navy QA Officer: Narciso A. Ancog Date: 1/11/2005
Narciso A. Ancog

DISTRIBUTION LIST

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Greg Swanson	Program QA Manager	Tetra Tech EM Inc.
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TABLE 1: ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

	EPA QA/R-5 QAPP ELEMENT[a]		Tetra Tech SAP
A1	Title and Approval Sheet		Title and Approval Sheet
A2	Table of Contents		Table of Contents
A3	Distribution List		Distribution List
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Problem Definition and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Non-direct Measurements	2.9	Nondirect Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods	4.2	Reconciliation with User Requirements
D3	Reconciliation with User Requirements		

Notes:

a EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

EPA U.S. Environmental Protection Agency
QAPP Quality assurance project plan
SAP Sampling and analysis plan
Tetra Tech Tetra Tech EM Inc.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

Appendix

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

%R	Percent recovery
1927 NAD	1927 North American Datum
1929 NGVD	1929 National Geodetic Vertical Datum
27 CCR	Title 27 of the Code of California Regulations
AA	Atomic absorption
ags	Above ground surface
ASTM	American Society for Testing and Materials
bgs	Below ground surface
CARB	California Air Resources Board
CLP	Contract laboratory program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
CPR	Cardiopulmonary resuscitation
DHS	Department of Health Services
DO	Delivery order
DQA	Data quality assessment
DQO	Data quality objective
DTSC	Department of Toxic Substances Control
E&E	Ecology and Environment
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FTL	Field team leader
GC/MS	Gas chromatography/mass spectrometry
GFAA	Graphite furnace atomic absorption
GIS	Geographic information system
HSC	Health and Safety Code
HASP	Health and safety plan
ICP	Inductively coupled plasma
ID	Identification
IDL	Instrument detection limit

ACRONYMS AND ABBREVIATIONS (Continued)

IDW	Investigation-derived waste
IRP	Installation Restoration Program
IRCDQM	Installation Restoration Chemical Data Quality Manual
LEL	Lower explosive limit
LFG	Landfill gas
LCS	Laboratory control sample
LIMS	Laboratory information management system
MCAWW	Methods for Chemical Analysis of Water and Waste
MDL	Method detection limit
MEC	Munitions and explosives of concerns
MS	Matrix spike
MSD	Matrix spike duplicate
msl	Mean sea level
MSR	Monthly status report
NEDTS	Navy Environmental Data Transfer Standards
NFESC	Naval Facilities Engineering Service Center
NWS	Naval Weapons Station
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyls
PE	Performance evaluation
PEL	Permissible exposure limits
PPE	Personal protective equipment
ppm	Parts per million
ppmv	Parts per million by volume
PRC	PRC Environmental Management, Inc.
PRRL	Project-required reporting limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QCSR	Quality control summary report
RI	Remedial investigation
ROD	Record of decision
RPD	Relative percent difference
RPM	Remedial project manager

ACRONYMS AND ABBREVIATIONS (Continued)

SAP	Sampling and analysis plan
SBD	Seal Beach Detachment
SDG	Sample delivery group
SI	Site investigation
SOP	Standard operating procedure
SOW	Statement of work
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
TIC	Tentatively identified compound
TSA	Technical systems audit
Tetra Tech	Tetra Tech EM Inc.
TO	Toxic organic
VOC	Volatile organic compound

1.0 PROJECT DESCRIPTION AND MANAGEMENT

Tetra Tech EM Inc. (Tetra Tech) is conducting landfill gas (LFG) characterization to support design of the landfill closure system at the Naval Weapons Station (NWS) Seal Beach Detachment (SBD) Concord, Site 1 Tidal Area Landfill in Concord, California. Tetra Tech prepared this sampling and analysis plan (SAP) to guide the field, laboratory, and data reporting efforts associated with this project.

Table 1 follows the approval page at the beginning of this SAP. The table demonstrates how this SAP addresses all the elements of a quality assurance project plan (QAPP) currently required by the U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document (EPA 2001).

Tables and figures follow the first reference in the text in this document. Appendix A contains method precision and accuracy goals, Appendix B presents the site-specific health and safety plan (HASP), Appendix C contains standard operating procedures (SOP), Appendix D contains all field forms, Appendix E lists project-required exposure limits, Appendix F lists laboratories that Tetra Tech has contracted to analyze samples collected under Navy contracts, Appendix G contains borings logs from previous investigations at the Tidal Area, Appendix H contains guidance from the California Integrated Waste Management Board (CIWMB), and Appendix I presents responses to agency comments.

1.1 PROBLEM DEFINITION AND BACKGROUND

This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Facility Background (Section 1.1.3)
- Site Description (Section 1.1.4)
- Physical Setting (Section 1.1.5)
- Summary of Previous Investigations (Section 1.1.6)
- Principal Decision-Makers (Section 1.1.7)
- Technical or Regulatory Standards (Section 1.1.8)

These standards will be used to provide guidelines for the assessment of LFG at the Tidal Area Landfill. Work will include integrated surface sampling in accordance with California Air Resources Board (CARB) guidelines and perimeter monitoring to check migration of gas from the landfill, as specified in Title 27 of the *California Code of Regulations* (27 CCR) 20925 perimeter monitoring network.

1.1.1 Purpose of the Investigation

The purpose of the investigation at the Site 1 Tidal Area Landfill is to conduct surface emissions screening, install perimeter LFG probes, and conduct limited testing for off-site gas migration to characterize LFG to support design for landfill closure.

As stipulated in the record of decision (ROD), the Navy will conduct a landfill gas survey using the standards in California's Health and Safety Code (HSC) Section 41805.5, CARB guidelines, and 27 CCR to evaluate whether any landfill gas control (active or passive venting or oxidation) system is necessary to protect human health and the environment and to assist with design of the gas collection system. If concentrations of gas detected during the survey exceed the requirements in 27 CCR 20921(a)(2) for gas migration, then the Navy would design and construct an LFG control system in consultation with county, state and federal regulators. The integrated surface sampling will be used to evaluate whether the landfill is generating LFG that could pose a potential threat to health. Regardless of the results of the LFG survey, some amount of LFG venting would be included in the design of the cap.

1.1.2 Problem to be Solved

A modified integrated surface emissions screening will be conducted, as specified in CARB guidance, to monitor for possible LFG generation at the surface of the landfill. Samples will be analyzed for methane, carbon dioxide, hydrogen sulfide, and trace gases commonly found in landfills, such as tetrachloroethene, trichloroethylene, methylene chloride, benzene, vinyl chloride, ethylene dichloride, chloroform, carbon tetrachloride, and ethylene dibromide. This one-time sampling event will be conducted to obtain data for the design of the LFG vents on the final cover of the landfill.

Subsurface gas monitoring probes will be installed to monitor possible subsurface LFG migration at the perimeter of the landfill to confirm that LFG emissions at the site comply with the requirements of 27 CCR Section 20921 (a)(2). Samples will be analyzed for methane and the other gases as listed above. This one-time sampling event will be conducted to determine that methane concentrations do not exceed the lower explosive level (LEL) of 5 percent by volume (50,000 parts per million by volume [ppmv]) in soil at the compliance boundary. If concentrations exceed 5 percent by volume, then an LFG control system is required. The integrated surface emissions screening will be conducted as soon as possible to provide design data for the cap.

The subsurface gas monitoring probes will eventually be used to verify that landfill gas has been contained. The subsurface gas monitoring probes will be installed before the cap is complete to monitor gas migration before and after the installation of the cap, and evaluate the effect that the cap has on gas migration, if any. The results of surface emissions screening and the initial sampling of subsurface gas monitoring probes will be discussed in a report to be completed before a final Site 1 Remedial Design is produced (scheduled for April 7, 2005, per the November 26, 2004, Draft Final Site Management Plan).

1.1.3 Facility Background

The Tidal Area Landfill is located along the western side of Johnson Road, just north of Froid Road (Figure 1). The Tidal Area Landfill, which covers 13 acres, served as the major disposal area for NWS Concord from approximately 1944 to 1979. During that time, the landfill received household refuse from the base and surrounding communities, as well as facility waste and construction debris. The landfill reportedly received solvents, acids, paint cans, creosote-treated timbers, asphalt, concrete, asbestos, and ordnance materials, including inert munitions. A wetland designated as a salt marsh is adjacent to the landfill along its western and southern boundaries (Figure 2). The closest civilian population to the landfill is 1.3 miles away.

The Tidal Area at NWS SBD Concord is located on a site that was originally occupied in part by a copper smelting operation from 1901 to 1908 and later by the Pacific Coast Shipbuilding Company. At that time, the area was known as "Bay Point." The copper smelting and ship building operations occurred in the area north of what is now the Tidal Area Landfill. The distance from the landfill to the former smelting and shipbuilding operations is estimated to be more than 1,000 feet. Otter Sluice was constructed to drain surface water and groundwater from the Tidal Area to Suisun Bay. The sluice is believed to have passed through the current location of the Tidal Area Landfill. During construction of NWS SBD Concord in 1942, the portion of this sluice that passed through the present location of the Tidal Area Landfill was backfilled, and the sluice was rerouted around the Tidal Area Landfill.

According to the initial assessment study, the explosive "tritonal" from a 750-pound, general-purpose bomb was reportedly buried in the landfill. However, the initial assessment study did not cite the source of this information. Subsequent inquiries also have not identified the source of the information. Navy sources consider the tritonal disposal to be highly unlikely because the protocol for disposal of explosives does not sanction landfill disposal. Furthermore, other safe and appropriate disposal methods for this type of material were in practice at the time. If tritonal was disposed of in violation of Navy rules, it would be subject to degradation with exposure to the elements. Degradation of tritonal by weathering tends to increase the stability of the material (Tetra Tech 2001, 2003).

Historical photographs indicate that the Tidal Area Landfill was created by the progressive disposal of debris placed directly on native soil outward from Johnson Road. Apparently, the area was not excavated before waste was discarded there. Waste as much as 10 feet thick was estimated from topographic evaluation; however, the waste may be unevenly distributed, and the ratio of waste to soil cover in the fill may be variable. There is no record of the degree of landfill subsidence that resulted from consolidation of the underlying Bay Mud. The area is currently covered by soil; however, the origin of the soil cover is unknown. A fence borders the edge of the landfill along Johnson Road but does not surround the landfill.

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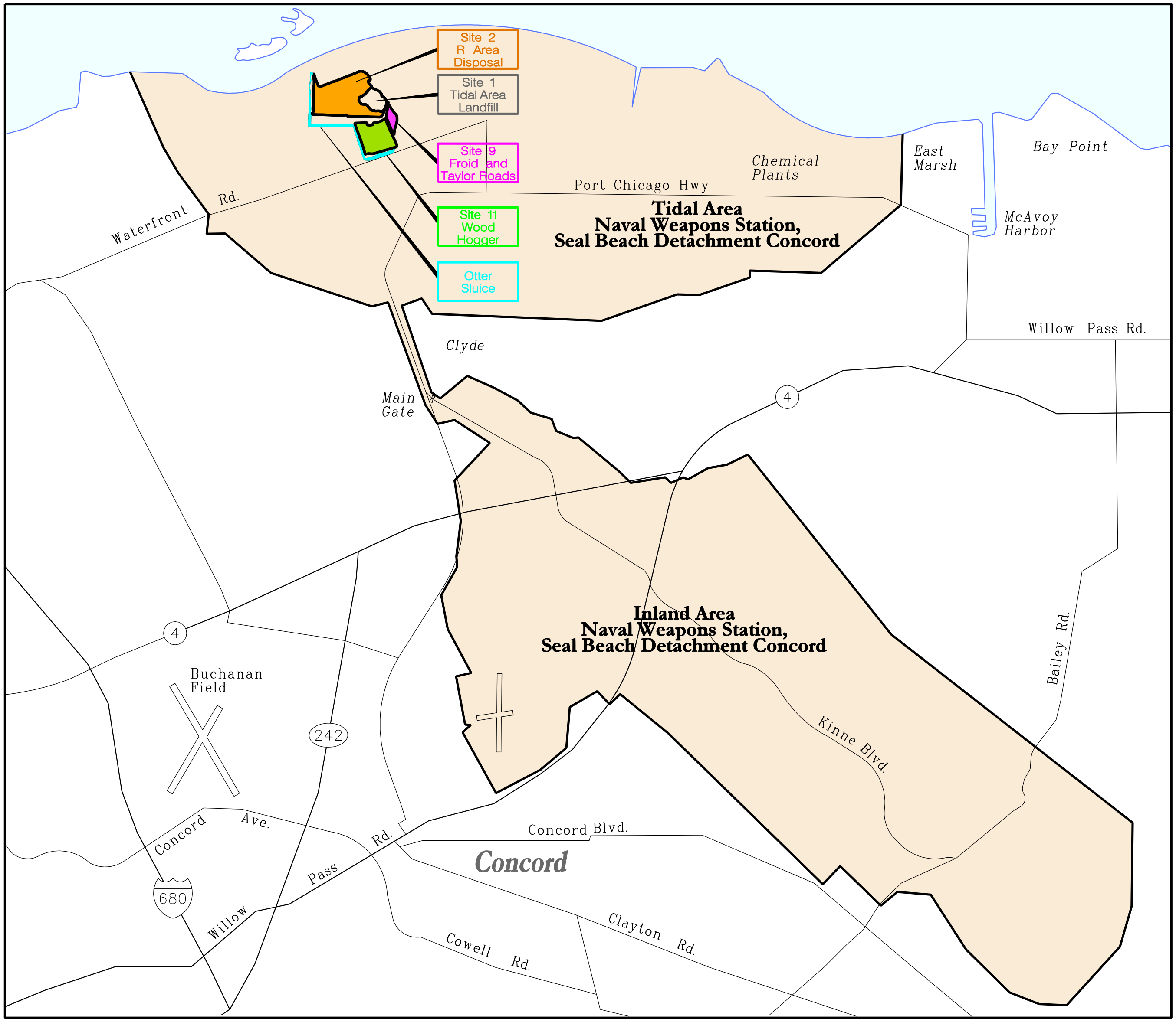

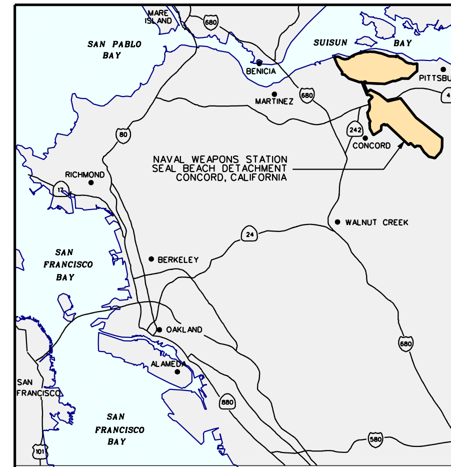

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SCALE IN FEET

Tetra Tech EM Inc.

NAVAL WEAPONS STATION SEAL BEACH DETACHMENT
CONCORD, CALIFORNIA
Integrated Product Team West, Daly City

FIGURE 1
REGIONAL MAP

Figure 2

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.

Groundwater elevations measured from December 1989 to January 1998 at the Tidal Area Landfill ranged from 3.20 feet below mean sea level (msl) to 3.54 feet above msl. Except for a few wells or measurement periods, water levels in the wells at the site were highest near the end of the wet season and are lowest near the end of the dry season. The response of water levels in landfill wells to seasonal rainfall indicates that groundwater is recharged by infiltration of precipitation. Because the waste has been measured at up to 10 feet thick at the landfill, it is clear that at least a portion of the waste is inundated.

The horizontal extent of the landfill has been established with a high degree of certainty based on historical aerial photographs and visual site inspections. The boundary of the landfill on the eastern side is delineated by a road; on the south, north, and west sides, the boundary is visually apparent as a sudden change in slope from the flat wetland to the raised mound of the landfill.

The landfill consists predominantly of ruderal non-native grassland habitat. The surface of the landfill is discontinuous soil cover that is mixed with waste throughout the depth of the landfill. Currently, rubble, metal scraps, and wood debris are visible through the layer of soil. Animal burrows and differential subsidence have resulted in a highly uneven surface interrupted by deep potholes.

1.1.4 Site Description

NWS SBD Concord is the major naval munitions transshipment facility on the West Coast and is located in the north-central portion of Contra Costa County, California, 30 miles northeast of San Francisco. The facility, which encompasses 13,000 acres, is bounded by Suisun Bay to the north, Los Medanos Hills and the City of Pittsburg to the east, and the City of Concord to the south and west. Currently, the facility contains two main separate land holdings: the Tidal Area (which includes islands in Suisun Bay), and the Inland Area (Figure 1).

1.1.5 Physical Setting

The 6,800-acre Tidal Area is located in a low marsh adjacent to Suisun Bay. The Tidal Area Landfill (Site 1) is one of four Tidal Area sites investigated by the Navy under the Installation Restoration Program (IRP). The IRP was established to identify, assess, and remediate uncontrolled hazardous substance, pollutant, and contaminant sites that resulted from military activities (PRC Environmental Management Inc. [PRC] 1995).

Endangered species and other wildlife inhabit portions of the Tidal Area, most of which is a wetland. A large section of the wetland was modified during construction of the original weapons station. Large amounts of fill were placed in the wetland, and an artificial sluice was constructed to control tidal inflows.

1.1.6 Summary of Previous Investigations

The following investigations were conducted at the Tidal Area Landfill and surrounding areas:

1.1.6.1 Historical Environmental Assessments of the Landfill

A summary of environmental investigations conducted at NWS SBD Concord before the remedial investigation (RI) is provided below. Although the investigations are described with IRP terms used before the Navy adopted EPA's terminology, the investigations are consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The investigations encompassed all four sites within the Tidal Area of NWS SBD Concord. However, the information summarized in the following paragraphs applies only to the Tidal Area Landfill.

The site was first investigated during an initial assessment study in 1983 (Ecology and Environment [E&E] 1983). The initial assessment study consisted of a search of historical records, a visual inspection of the site, and interviews with personnel at NWS SBD Concord. Based on the historical information, the site was recommended for further study. A site investigation (SI) of the Tidal Area Landfill was subsequently conducted from April 1988 to January 1991. Samples of groundwater, surface water, soil, and sediment were collected within the Tidal Area Landfill. Results revealed the presence of volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polynuclear aromatic hydrocarbons, the pesticide dieldrin, the polychlorinated biphenyl (PCB) Aroclor-1260, metals, and the nitroaromatic explosive compound nitrobenzene. The Navy documented its intent to use a presumptive remedy approach in December 1994, in the draft final work plan for the RI/feasibility study (FS) for tidal area sites (PRC 1994). Based on EPA's presumptive remedy for CERCLA municipal landfill sites (EPA 1993), a multilayer prescriptive soil cap for a municipal solid waste landfill that meets the requirements of 27 CCR was proposed and selected.

The boundary of the Tidal Area Landfill site, as defined in the SI report, was larger than the current boundary shown on Figure 1. During the SI, the landfill area was defined to include the landfill itself and a bordering zone of potential influence. In the RI, however, the boundary was modified to reduce the size to be equal to the area where the waste was deposited. As a result, many of the SI sampling locations for the Tidal Area Landfill are outside the boundary of the landfill as it is currently defined. Samples from these locations were collected within the wetland area now called the R Area, Site 2.

A confirmation sampling study was conducted in 1993 to confirm the results of quarterly sampling during the SI. A limited number of soil, sediment, and groundwater samples were analyzed to verify the extent of organic constituents in groundwater. No organic compounds or pesticides were detected in these samples (PRC and Montgomery Watson 1993).

1.1.6.2 Remedial Investigation and Confirmation Groundwater Sampling Study for the Tidal Area

Data collected during the SI and the 1993 confirmation sampling study were used in planning the RI at the Tidal Area Landfill. A confirmation sampling study for groundwater was later conducted in September and October 1997 to address outstanding questions that involved site hydrology and groundwater in the Tidal Area (Tetra Tech 1998). The nature and extent of contamination at the Tidal Area Landfill as well as the chemicals of potential concern based on RI screening criteria and the confirmation groundwater sampling study are described in the ROD (Tetra Tech 2004).

1.1.7 Principal Decision-Makers

Principal decision makers include the Navy and regulatory agencies (including the Department of Toxic Substances Control [DTSC], the California Regional Water Quality Control Board, and the CIWMB). These decision makers will use the data collected from this project, in conjunction with data generated previously during the historical environmental assessments of the landfill, as well as the RI and confirmation groundwater sampling study for the Tidal Area, to evaluate whether any landfill gas control (active or passive venting or oxidation) system is necessary to protect human health and the environment and to assist with gas collection design.

1.1.8 Technical or Regulatory Standards

For planning, the Navy assumes that Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL) (OSHA 2003) will be the action levels applied to this site.

Current OSHA PELs are listed in Appendix E. These PELs will be used for initial screening of field and analytical results; however, they will not be used for compliance, as specific regulatory action levels have not been established for this site.

The Navy will conduct the landfill gas survey using the standards in HSC 41805.5, CARB guidelines, CIWMB LFG guidelines, and 27 CCR.

1.2 PROJECT DESCRIPTION

The following sections discuss the objectives and measurements of the project. Table 2 presents a schedule of sampling, analysis, and reporting for this project.

TABLE 2: IMPLEMENTATION SCHEDULE FOR SAMPLING, ANALYSIS, AND REPORTING

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Milestone	Anticipated Date
Final Landfill Gas SAP	January 17, 2005
Field Investigation	February 1-2, 2005
Draft Landfill Gas Letter Report	February 28, 2005
Final Landfill Gas Letter Report	March 28, 2005

Note:

SAP Sampling and analysis plan

1.2.1 Project Objectives

As stated in Section 1.1, the primary objective of this scope of work is to evaluate whether any landfill gas control (active or passive venting or oxidation) system is necessary to protect human health and the environment and to assist with gas collection design. The need for landfill gas control will be evaluated by conducting a modified integrated surface emissions and perimeter LFG monitoring probe sampling event to characterize landfill gas at the Tidal Area Landfill. These data will be used to support closure design in accordance with 27 CCR. The following field activities have been incorporated into the scope of work for this project to meet these objectives and will be carried out at the Tidal Area Landfill:

- Conduct integrated surface sampling at selected landfill surface locations.
- Install and monitor three LFG perimeter monitoring probes

1.2.2 Project Measurements

Surface emissions screening and perimeter LFG monitoring probe samples will be measured in the field for methane, carbon dioxide, oxygen, and nitrogen. Based on the surface screening results, eight (8) LFG samples will be collected and analyzed for VOCs using Toxic Organics (TO)-15 and fixed gases using American Society for Testing and Materials (ASTM) Standard D 1946 at an off-site laboratory. The 8 samples will be collected from various locations within the landfill based on (1) locations of surface screening samples where the highest concentrations were detected and/or (2) representative sampling of the landfill (areal coverage).

1.3 Quality Objectives and Criteria

The following sections present the data quality objectives (DQO) and measurement quality objectives (MQO) identified for this SAP.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000b, 2000d). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project regarding LFG characterization and perimeter monitoring probes are presented in Tables 3 and 4.

TABLE 3: DATA QUALITY OBJECTIVES FOR LANDFILL GAS CHARACTERIZATION

Tidal Area Landfill (Site 1) Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 1: State the Problem

Landfill gas (LFG) is produced as a result of anaerobic decomposition of organic material in landfill wastes. In addition to fixed gases (oxygen and nitrogen) that are present in normal air, LFG is composed primarily of methane, carbon dioxide, hydrogen sulfide, and trace gases such as perchloroethylene, trichloroethylene, methylene chloride, benzene, vinyl chloride, ethylene dichloride, chloroform, carbon tetrachloride, and ethylene dibromide. The concentrations of each gas vary with the stage of decomposition and the characteristics of the waste matters. To date, the Navy has not collected data on methane, fixed gasses, and/or VOCs and, therefore, the concentration of these gases are unknown.

To evaluate the characteristics of any LFG that may be generated at the site, surface emissions will be screened in a similar manner as is described in the Testing Guidelines for Active Solid Waste Disposal Site per California Health and Safety Code Section 41805.5 by the California Air Resources Board (CARB). Samples will be analyzed for methane and other gases as listed above. This one-time sampling event will be conducted to provide data for the design of the LFG vents on the final cover of the landfill.

STEP 2: Identify the Decisions

The primary decision to be made concerns the amount of landfill gas venting warranted for the final design of the cover. Decisions regarding the number and placement of LFG vents will be based on the results of the LFG screening and sampling data evaluation. The following questions must be answered to make that decision and to characterize the LFG at the site:

1. Do concentrations of LFG on the surface of the site exceed 50 parts per million (ppm)? This is a screening level identified in Testing Guidelines for Active Solid Waste Disposal Site per California Health and Safety Code Section 41805.5 by the CARB.
2. If LFG is detected above 50 ppm on the surface of the landfill, do the chemical characteristics of the trace gasses at the highest detection point exceed the permissible explosive limits (PEL)?

STEP 3: Identify Inputs to the Decisions

The LFG surface emissions screening steps were designed based on a review of site characteristics and in accordance with CARB guidance. The primary objective is to determine the concentrations of methane and other gases as listed above at the surface of the landfill. Work will include surface screening with field instruments to determine if the landfill is generating LFG and laboratory analysis to characterize the LFG.

STEP 4: Define Study Boundaries

- The lateral extent of the study area is defined as shown on Figure 2.
- Temporal boundaries are this sampling event.

STEP 5: Develop Decision Rules

Potential gas migration from the surface of the landfill will be evaluated in accordance with CARB guidelines. The following decision rules will apply:

1(a) If landfill gases are detected at concentrations greater than 50 ppm measured as methane at the landfill surface monitoring points, then LFG is being generated at the site and additional monitoring and corrective actions (such as, installation of LFG vents) will be recommended.

1(b) If landfill gases are not detected at concentrations greater than 50 ppm measured as methane at the landfill surface monitoring points, then significant quantities of LFG are not being generated at the site; however installation of LFG vents is still required by the ROD.

2(a) If trace gas concentrations exceed the PELs, then additional monitoring and corrective actions (such as installation of LFG vents) will be recommended.

2(b) If trace gas concentrations do not exceed the PELs, then the LFG does not contain significant quantities of trace VOCs; however installation of LFG vents is still required by the ROD.

TABLE 3: DATA QUALITY OBJECTIVES FOR LANDFILL GAS CHARACTERIZATION (Continued)

Tidal Area Landfill (Site1) Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 6: Specify Tolerable Limits on Decision Errors
Because decisions will be based primarily on field- and laboratory-generated analytical data, decision errors could result from the sampling process and limits of analyses. Statistically derived error limits cannot be calculated for this work because professional judgment will be used in selecting all sample locations. Therefore, no tolerable decision error rates were set for the sampling design because of the judgmental component of the sampling approach. It is therefore difficult to assess whether specific decision error rates for sampling design have been attained.
STEP 7: Optimize the Sampling Design
CARB guidance specifies that the air immediately above the disposal site surface be tested using the specified integrated surface sampling technique. The LFG data required will be collected through both field-based and laboratory-based sampling approaches. In general, the concentration of methane and other major gases (oxygen, carbon dioxides, and hydrogen sulfide) will be measured in the field on a real-time basis with a gas analyzer capable of detecting concentrations of methane to a resolution of 0.1 percent by volume. The concentration of trace volatile organic compound (VOC) gases will be obtained through laboratory analyses that are based on analytical methods with detection limits below the decision criteria (such as the PELs). A one-time monitoring event will be conducted. If the landfill is generating significant quantities of LFG, the characterization data will be used to design a venting system for the final landfill cap.

TABLE 4: DATA QUALITY OBJECTIVES FOR LANDFILL GAS PERIMETER MONITORING PROBES

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 1: State the Problem
Landfill gas (LFG) is produced as a result of anaerobic decomposition of organic material in landfill wastes. In addition to fixed gases (oxygen and nitrogen) that are present in normal air, LFG is composed primarily of methane, carbon dioxide, hydrogen sulfide, and trace gases such as perchloroethylene, trichloroethylene, methylene chloride, benzene, vinyl chloride, ethylene dichloride, chloroform, carbon tetrachloride, and ethylene dibromide. The concentrations of each gas vary with the stage of decomposition and the characteristics of the waste matters. To date, the Navy has not collected data on methane, fixed gasses, and/or VOCs and, therefore, the concentration of these gases are unknown. To evaluate whether landfill gas is migrating from the site at combustible levels (approximately 5 to 15 percent [by volume] in air), the requirements of Title 27 Code of California Regulations (CCR) 20921 for subsurface gas monitoring probes will be used to monitor for possible subsurface migration of LFG at the property boundary or alternative compliance boundary in accordance with the substantive portions of 27 CCR 20925. Samples will be analyzed for methane and other gases, as listed above. This event will be conducted to determine if methane concentrations exceed the lower explosive limit (LEL) of 5 percent by volume (50,000 parts per million by volume [ppmv]) in soil at the boundary or to determine what the methane gas concentrations are relative to state regulatory standards. After construction of the cap, the potential for gas migration could change. As such, the methane monitoring is not anticipated to be a one-time event but will rather be repeated until a variance is secured.
STEP 2: Identify the Decisions
The primary decision to be made is whether further remedial action is necessary at this site. The following questions must be answered to make that decision: 1. If LFG is migrating off site, are the concentrations such that they exceed the regulatory limit of 5 percent set forth in 27 CCR? 2. If LFG is migrating off site, are the concentrations of trace gas a potential threat to health?
STEP 3: Identify Inputs to the Decisions
The LFG monitoring probes were designed based on a review of site characteristics and in accordance with the requirements set forth in 27 CCR 20923 and 20925. LFG will be characterized in accordance with the requirements of 27 CCR 20932 and California Air Resources Board (CARB) guidance. The primary objective is to assess the presence and concentrations of methane and other gases, as listed above, at the site perimeter to obtain information for the design of the monitoring system. If an LFG monitoring system is required, it will be designed in accordance with 27 CCR 20937.
STEP 4: Define Study Boundaries
• The lateral extent of the study area is defined as shown on Figure 2. • The depth of the study area is defined by the deepest LFG monitoring probe (approximately 2 feet below the historical low groundwater elevation). • Temporal boundaries are this sampling event.

TABLE 4: DATA QUALITY OBJECTIVES FOR LANDFILL GAS PERIMETER MONITORING PROBES

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 5: Develop Decision Rules
Potential gas migration will be evaluated in compliance with 27 CCR 20921. The following decision rules will apply: 1(a) If landfill gases are detected at concentrations greater than 5 percent measured as methane at the LFG monitoring probes, then LFG is migrating from the site at combustible levels, and additional monitoring and corrective actions to control LFG migration will be recommended. 1(b) If landfill gases are not detected at concentrations greater than 5 percent measured as methane at the LFG monitoring probes, then LFG is not migrating from the site at combustible levels, and additional corrective actions to control LFG migration will not be recommended. 2(a) If concentrations of trace gases exceed the permissible exposure limits (PELs), then additional monitoring and corrective actions to control trace VOC migration will be recommended. 2(b) If concentrations of trace gases do not exceed the PELs, then additional monitoring and corrective actions to control trace VOC migration may not be recommended.
STEP 6: Specify Tolerable Limits on Decision Errors
Decision errors could result from the sampling process and limits of analysis because decisions will be based primarily on field- and laboratory-generated analytical data. Statistically derived error limits cannot be calculated for this work because professional judgment will be used in selecting all sample locations. Therefore, no tolerable decision error rates were set for the sampling design because of the judgmental component of the sampling approach. It is therefore difficult to assess whether specific decision error rates for sampling design have been attained.
STEP 7: Optimize the Sampling Design
Title 27 CCR 20925 specifies that perimeter multi-level probes be installed at maximum intervals of 1,000 feet. However, no probes will be necessary because of the hydraulic barriers since surface water is present along the northwestern, western, and southwestern boundaries. Because of the shallow groundwater table, single-level probes will be used, and the screened intervals of the probes will be located in a permeable formation that is conducive to gas migration. The required LFG data will be collected through both field- and laboratory-based sampling approaches. In general, the concentration of methane and other major gases (oxygen, carbon dioxides, and hydrogen sulfide) will be measured in the field on a real-time basis with a gas analyzer capable of detecting concentrations of methane to a resolution of 0.1 percent by volume. The concentration of trace VOC gases will be obtained through laboratory analyses that are based on analytical methods with detection limits below the decision criteria (such as the PELs). A baseline monitoring event will be conducted. If the baseline monitoring indicates that an LFG control system is needed (methane is found migrating offsite at unacceptable levels), an LFG control plan will be proposed as part of the baseline monitoring report.

1.3.2 Measurement Quality Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively by collecting the quality control (QC) samples listed in Table 5. Specific precision and accuracy goals for these QC samples are listed in Appendix A.

TABLE 5: QC SAMPLES FOR PRECISION AND ACCURACY
Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

QC Type	Precision	Accuracy	Frequency
Field QC	Field Duplicates	None Trip Blank	Field Duplicate = 1/10 samples Trip Blank = 1 per shipment
Laboratory QC	RPD	Method Blanks LCS or Blank Spikes Surrogate Standards %R	Method Blank = 1/20 samples LCS or Blank Spikes = 1/20 samples Surrogate Standards = Every sample for organic analysis by GC

Notes:

%R	Percent recovery
GC	Gas chromatography
LCS	Laboratory control sample
MS/MSD	Matrix spike/matrix spike duplicate
QC	Quality control
RPD	Relative percent difference

The sections below describe each of the PARCC parameters and how they will be assessed within this project.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD):

$$RPD = \frac{|A-B|}{(A+B)/2} \; x \; 100\%$$

where:

A = First duplicate concentration

B = Second duplicate concentration

Field sampling precision is evaluated by analyzing field duplicate samples. However, because it is not practical to obtain true field duplicate samples, field duplicates will not be collected for this project.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be generated for all analytes. The results of the analysis of each MS/MSD pair will be used to calculate an RPD for evaluating precision.

1.3.2.2 Accuracy

A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$Percent\ \ Recovery = \frac{S - C}{T}\ \ x\ \ 100$$

where:

S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike

Appendix A presents accuracy goals for the investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis on the results of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Field blanks (if appropriate) and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

As discussed further in Section 4.2, completeness will also be evaluated as part of the data quality assessment process (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

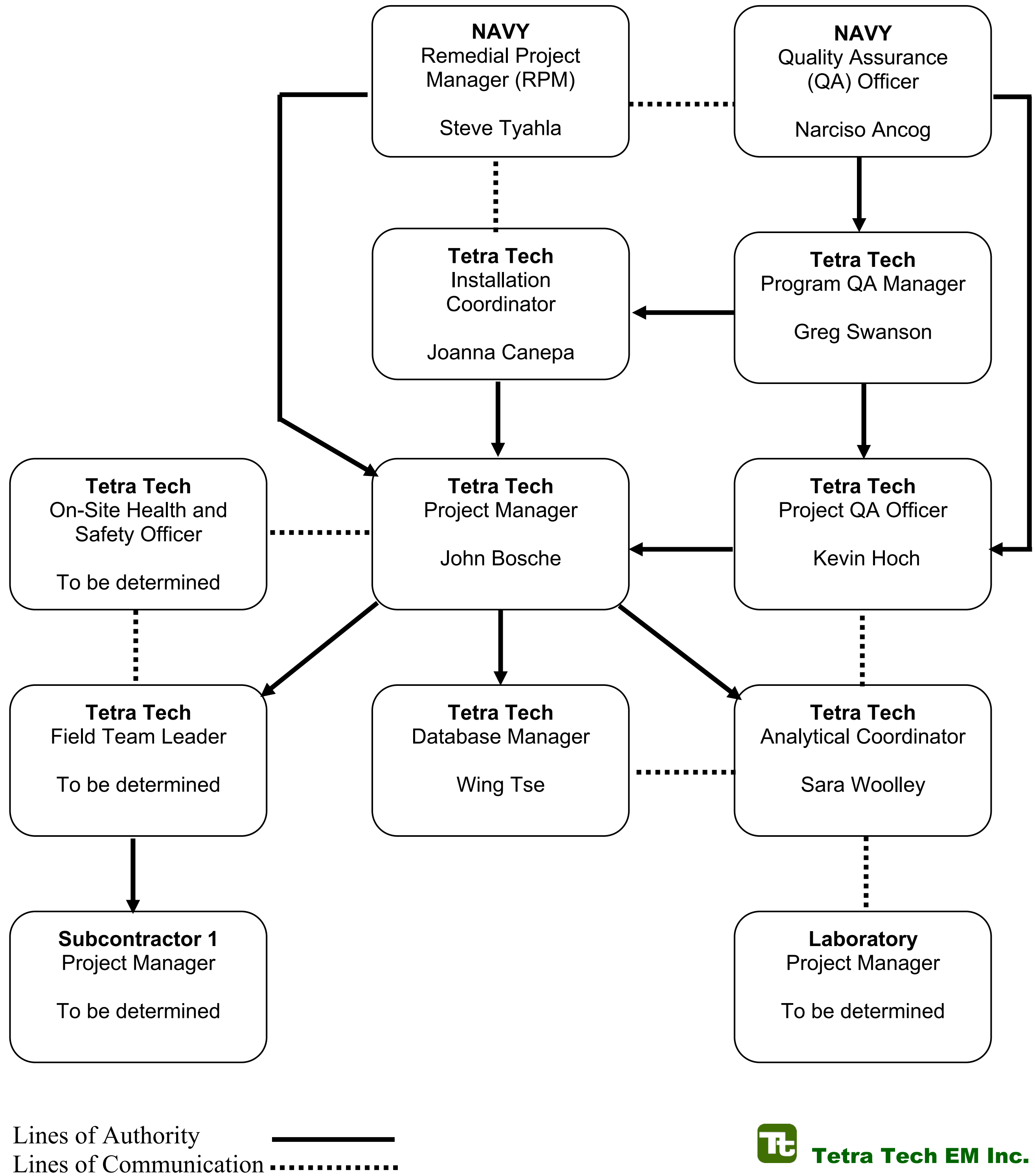
1.3.2.6 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. Project required reporting limits (PRRL) are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRRLs, which are established by Tetra Tech in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

PELs will be used for initial screening of field and analytical results; however, they will not be used for compliance, as specific regulatory action levels have not been established for this site. Current OSHA PELs are listed in Appendix E, Table E-2.

1.4 PROJECT ORGANIZATION

Figure 3 presents the organization of the project team. Table 6 presents the responsibilities and contact information for key personnel involved in sampling activities at the Tidal Area Landfill. In some cases, more than one responsibility has been assigned to one person.



Tetra Tech EM Inc.

Naval Weapons Station Seal Beach Detachment
Concord, California
Integrated Product Team West, Daly City

FIGURE 3
PROJECT TEAM ORGANIZATION CHART
Site 1 Tidal Area Landfill LFG Characterization

TABLE 6: KEY PERSONNEL

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
Steve Tyahla	Navy	Remedial project manager	Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management Actively participates in data quality objective (DQO) process Provides management and technical oversight during data collection	Department of the Navy Naval Facilities Engineering Command Southwest Integrated Product Team, West stephen.f.tyahla@navy.mil (650) 746-7451
Narciso A. Ancog	Navy	QA officer	Responsible for quality assurance (QA) issues for all Southwest Division (SWDIV) environmental work Provides government oversight of Tetra Tech EM Inc.'s (Tetra Tech) quality assurance (QA) program Reviews and approves sampling and analysis plan (SAP) and any significant modifications Has authority to suspend project activities if Navy quality requirements are not met	Naval Facilities Engineering Command, SWDIV, San Diego, CA narciso.ancog@navy.mil (619) 532-2540
Joanna Canepa	Tetra Tech	Installation coordinator	Responsible for ensuring that all Tetra Tech activities at this installation are carried out in accordance with current Navy requirements and Tetra Tech define AERCRU (AECRU) program guidance	Tetra Tech, San Francisco, CA joanna.canepa@ttemi.com (415) 222-8362
John Bosche	Tetra Tech	Project manager	Responsible for implementing all activities called out in delivery order (DO) Prepares or supervises preparation of SAP Monitors and directs field activities to ensure compliance with requirements of the SAP	Tetra Tech, San Francisco, CA john.bosche@ttemi.com 415-222-8295
Greg Swanson	Tetra Tech	Program QA manager	Responsible for regular discussion and resolution of QA issues with Navy QA officer Provides program-level QA guidance to installation coordinator, project manager, and project teams Reviews and approves SAPs Identifies nonconformances through audits and other QA review activities and recommends corrective action	Tetra Tech, San Diego, CA Greg.Swanson@TtEMI.com 619-525-7188
Kevin Hoch	Tetra Tech	Project QA officer	Responsible for providing guidance to project teams that are preparing SAPs Verifies that data collection methods specified in SAP comply with Navy and Tetra Tech requirements May conduct laboratory evaluations and audits	Tetra Tech, Sacramento, CA **kevin.hoch@ttemi.com** (916) 853-4506

TABLE 6: KEY PERSONNEL (Continued)
Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
To be determined	Tetra Tech	Field team leader	Responsible for directing day-to-day field activities conducted by Tetra Tech and subcontractor personnel Verifies that field sampling and measurement procedures follow SAP Provides project manager with regular reports on status of field activities	To be determined
To be determined	Tetra Tech	On-site safety officer	Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels Conducts safety briefings for Tetra Tech and subcontractor personnel and site visitors Can suspend operations that threaten health and safety	To be determined
Sara Woolley	Tetra Tech	Analytical coordinator	Responsible for working with project team to define analytical requirements Assists in selecting a pre-qualified laboratory to complete required analyses (see Section 2.4 of SAP) Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics Reviews laboratory data before they are released to project team	Tetra Tech, San Francisco, CA Sara.Woolley@TtEMI.com (415) 222-8311
Wing Tse	Tetra Tech	Database manager	Responsible for developing, monitoring, and maintaining project database under guidance of project manager Works with analytical coordinator during preparation of SAP to resolve sample identification issues	Tetra Tech, San Francisco, CA wing.tse@ttemi.com (415) 222-8326
To be determined	Laboratory	Project manager	Responsible for delivering analytical services that meet requirements of SAP Reviews SAP to understand analytical requirements Works with Tetra Tech analytical coordinator to confirm sample delivery schedules Reviews laboratory data package before it is delivered to Tetra Tech	To be determined
To be determined	Subcontractor	Project manager	Responsible for ensuring that subcontractor activities are conducted in accordance with requirements of SAP Coordinates subcontractor activities with Tetra Tech project manager or field team leader	To be determined

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for personnel working on site.

1.5.1 Health and Safety Training

Personnel who work at hazardous waste project sites are required to meet the OSHA training requirements defined in Title 29 Code of Federal Regulations (29 CFR) Part 1910.120(e). These requirements include: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. OSHA training will include an ordnance and explosive waste (OEW) refresher course. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent. Personnel performing the sampling beneath the building will have confined space entry training.

Copies of contractor's health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are maintained in project files.

Before work begins at a specific hazardous waste project site, contractor's personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at a hazardous waste project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the site-specific HASP (Appendix B)

1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to contractor.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Safety Meeting Sign-Off Sheet" before they conduct on-site work. This briefing covers the topics described in Section 1.5.1 and is conducted by the Tetra Tech on-site health and safety officer or other qualified person.

Subcontractors are responsible for conducting their own safety briefings. Contractor personnel may audit these briefings.

1.5.3 Specialized Training and Certification Requirements

Field personnel shall be in compliance with OSHA training requirements and be knowledgeable in the methods and procedures for monitoring LFG. In addition, the drilling subcontractor shall be certified according to the requirements at CCR Division 8, Title 16, Article 3, Classification 57.

1.6 Documents and Records

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.6.1 Field Documentation

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the delivery order (DO) number, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials

- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

The field team will also use the various field forms included in Appendix D to record field activities.

1.6.2 Summary Data Package

The subcontracted laboratory will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA 1999b, 2000a). The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and quality assurance (QA) and quality control (QC) summaries. The case narrative will include the following information:

- Subcontractor name, project name, DO number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample identification (ID) numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional requirements for the summary data package are outlined in Table 7. The subcontracting laboratory will provide Tetra Tech with two copies of the summary data package within 28 days after it receives the last sample in the SDG.

1.6.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOWs (EPA 1999b, 2000a). Full data packages will contain all of the information from the summary data package and all associated raw data. Requirements for the full data package are outlined in Table 7. Full data packages are due to Tetra Tech within 35 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

TABLE 7: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Summary Data Packages – Organic Analysis	Requirements for Summary Data Packages – Inorganic Analysis
Section I **Case Narrative**	**Section I** **Case Narrative**
1. Case narrative	1. Case narrative
2. Copies of nonconformance and corrective action forms	2. Copies of nonconformance and corrective action forms
3. Chain-of-custody forms	3. Chain-of-custody forms
4. Copies of sample receipt notices	4. Copies of sample receipt notices
5. Internal tracking documents, as applicable	5. Internal tracking documents, as applicable
Section II **Sample Results - Form I for the following:**	**Section II** **Sample Results - Form I for the following:**
1. Environmental samples, including dilutions and re-analysis	1. Environmental samples, including dilutions and re-analysis
2. Tentatively identified compounds (TIC) (VOC and SVOC only)	
Section III **QA/QC Summaries - Forms II through XI for the following:**	**Section III** **QA/QC Summaries - Forms II through XIV for the following:**
1. System monitoring compound and surrogate recoveries (Form II)	1. Initial and continuing calibration verifications (Form II)
2. MS and MSD recoveries and RPDs (Forms I and III)	2. PRRL standard (Form II)
3. Blank spike or LCS recoveries (Forms I and III-Z)	3. Detection limit standard (Form II-Z)
4. Method blanks (Forms I and IV)	4. Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5. Performance check (Form V)	5. Inductively coupled plasma (ICP) interference-check samples (Form IV)
6. Initial calibrations with retention time information (Form VI)	6. MS and post-digestion spikes (Forms V and V-Z)
7. Continuing calibrations with retention time information (Form VII)	7. Sample duplicates (Form VI)
8. Quantitation limit standard (Form VII-Z)	8. LCSs (Form VII)
9. Internal standard areas and retention times (Form VIII)	9. Method of standard additions (Form VIII)
10. Analytical sequence (Forms VIII-D and VIII-Z)	10. ICP serial dilution (Form IX)
11. Gel permeation chromatography (GPC) calibration (Form IX)	11. IDL (Form X)
12. Single component analyte identification (Form X)	12. ICP interelement correction factors (Form XI)
13. Multicomponent analyte identification (Form X-Z)	13. ICP linear working range (Form XII)
14. Matrix-specific method detection limit (MDL) (Form XI-Z)	

TABLE 7: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES (Continued)

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Full Data Packages -- Organic Analysis

Sections I, II, and III **Summary Package**

Section IV **Sample Raw Data - indicated form, plus all raw data**

1. Analytical results, including dilutions and re-analysis (Forms I and X)
2. Tentatively identified compounds (TICs) (Form I — VOC and SVOC only)

Section V **QC Raw Data - indicated form, plus all raw data**

1. Method blanks (Form I)
2. MS and MSD samples (Form I)
3. Blank spikes or LCSs (Form I)

Section VI **Standard Raw Data - indicated form, plus all raw data**

1. Performance check (Form V)
2. Initial calibrations, with retention-time information (Form VI)
3. Continuing calibrations, with retention-time information (Form VII)
4. Quantitation-limit standard (Form VII-Z)
5. GPC calibration (Form IX)

Section VII **Other Raw Data**

1. Percent moisture for soil samples
2. Sample extraction and cleanup logs
3. Instrument analysis log for each instrument used (Form VIII-Z)
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

Requirements for Full Data Packages -- Inorganic Analysis

Sections I, II, III **Summary Package**

Section IV **Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption (GFAA), flame atomic absorption (AA), cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:**

1. Environmental samples, including dilutions and re-analysis
2. Initial calibration
3. Initial and continuing calibration verifications
4. Detection limit standards
5. Method blanks, continuing calibration blanks, and preparation blanks
6. ICP interference check samples
7. MS and post-digestion spikes
8. Sample duplicates
9. LCSs
10. Method of standard additions
11. ICP serial dilution

Section V **Other Raw Data**

1. Percent moisture for soil samples
2. Sample digestion, distillation, and preparation logs, as necessary
3. Instrument analysis log for each instrument used
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

1.6.4 Data Package Format

The subcontracted laboratory will provide electronic data deliverables (EDD) for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDDs. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDDs will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with Navy Environmental Data Transfer Standards (NEDTS). Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG
- All re-analysis, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples

Electronic and hard-copy data must be retained for a minimum of 3 and 10 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

1.6.5 Reports Generated

An LFG characterization report for the Site 1 Tidal Area Landfill characterization activities will be prepared at the conclusion of the field work. The report will include a summary of the results of previous related investigations, field and sampling procedures for the LFG characterization, target analyte concentration and associated QC data, conclusions, and recommendations for the site.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following:

- Sampling Process Design (Section 2.1)
- Sampling Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)

- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Non-Direct Measurements (Section 2.9)
- Data Management (Section 2.10)

2.1 Sampling Process Design

The presence of LFG at the Tidal Area Landfill will be addressed using the CIWMB guidelines for integrated surface sampling and limited off-site testing for gas migration using the standards for LFG perimeter monitoring in 27 CCR 20925. The use of perimeter monitoring is consistent with CARB guidelines for LFG characterization. Infill gas characterization probes were not proposed to avoid any potential risk from munitions and explosives of concerns (MEC).

The samples collected from this effort will be used to characterize the LFG. The following sections present discussions of surface emissions screening, LFG sampling, installation of the perimeter LFG probes, limited off-site testing for gas migration, and planned chemical analyses. Section 2.1 also includes information on surveying the locations of the LFG monitoring probes.

2.1.1 Emissions Screening and Landfill Gas Sampling

The integrated surface sample is a method of characterizing emissions from a disposal site. Integrated surface sampling is designed to sample the landfill gas emissions immediately after they have passed through the final cover and have entered the atmosphere. Because the sampling system will dilute the emitted landfill gas, use of more sensitive analytical methods is necessary to adequately characterize the sample.

Sample locations will be selected in the field to evaluate potential LFG emissions from the surface of the landfill. Location for samples will be selected so all major portions of the landfill are sampled for gas emission.

Once background concentrations are measured following CARB procedures, the surface of the landfill will be screened to evaluate potential LFG emissions. Monitoring points where the concentration of methane is greater than 50 parts per million (ppm) will be recorded on a topographic map. Surface monitoring points will be identified in the field and will include selected surface cracks. Areas that are not monitored for safety reasons will also be recorded on a topographic map. An LFG analyzer (such as a Lantec Gem 500 model or equivalent) will be used in the field to measure methane, oxygen, and carbon dioxide. A portable hydrogen sulfide analyzer (Jerome 631-X or equivalent) will also be used to measure levels of hydrogen sulfide. A sample will be collected from the location exhibiting the highest concentration of methane and analyzed for VOCs using TO-15 and for fixed gases using ASTM D 1946. Samples will be analyzed at a certified laboratory.

The location IDs for the surface LFG samples, the sample IDs, and the rationale for selecting these sample locations are presented in Table 8. The proposed sampling locations will be designated TLSS0X and will continue with consecutive numbering. Samples for chemical analysis will be submitted to California state-certified laboratories that have been approved by the Navy.

2.1.2 Perimeter LFG Probe Installation and Limited Off-Site Gas Migration Testing

In accordance with 27 CCR 20925, three perimeter LFG monitoring probes will be installed around the boundary of the property or alternative compliance boundary, outside the refuse, but within the property. Proposed locations for monitoring probes are approximately shown on Figure 2, as locations will be selected in the field. Each probe will be located in native soil adjacent to the waste footprint to monitor the lateral migration of LFG outside the boundary of the landfill (27 CCR 20925[a]). The probes will be installed as part of the landfill final closure.

According to regulatory requirements (27 CCR 20925[b]), the lateral spacing between adjacent probes is not to exceed 1,000 feet. However, no probes will be necessary along the northwestern, western, and southwestern boundaries because of the hydraulic barriers created by the waterways in these areas.

In accordance with regulatory requirements (27 CCR 20925 [c][1]), the depth of the probe borehole must equal the maximum depth of waste as measured within 1,000 feet of the monitoring point. Because the groundwater elevations are shallow, multi-level probes cannot be used. Each location will therefore consist of one probe installed above the permanent low seasonal water table. The permanent low seasonal water table is not computed but will be determined from the historically lowest measured groundwater elevation measured from one of the monitoring wells along the eastern perimeter of the site (monitoring wells TLSMW003, TLSMW004, and TLSMW005, see Figure 4). The depths of the probes within the borehole will be adjusted in response to the geologic characteristics of the site and will be placed adjacent to soil that is conducive to gas flow. (See Figures 4 through 8 for locations of geologic cross sections and geologic cross sections E-E’ to H-H’.) Select boring logs are presented in Appendix G.

Each LFG monitoring probe will be installed in accordance with requirements of 27 CCR 20925(d). The probe boreholes will be advanced using hollow-stem auger drilling equipment. The site geologist will log the soil cuttings in accordance with ASTM Procedure D 2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).* An as-built record of each monitoring location will be prepared and will include the following:

TABLE 8: PROPOSED LANDFILL GAS SAMPLES, RATIONALE, AND ANALYSES
Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Location Name	Analyses	Landfill Gas Sample ID	Sample Depth	Rationale
GMP1	VOCs and fixed gases	032GMP1	Above the permanent low seasonal water table	According to regulatory requirements (27 CCR 20925[b]), the lateral spacing between adjacent probes is not to exceed 1,000 feet. Wells will be spaced to align with gas permeable structural or stratigraphic features, such as dry sand or gravel, off site or on site structures, and areas of dead or stressed vegetation that might be due to gas migration.
GMP2	Same as above	032GMP2	Same as above	Same as above.
GMP3	Same as above	032GMP3	Same as above	Same as above.
TLSS0X, locations will be consecutively numbered	Same as above	DO#TLSS0X, samples will be consecutively numbered	2 to 3 inches ags	A modified integrated surface sampling protocol is proposed so all major portions of the landfill are sampled for gas emission.

Notes:

ags Above ground surface
CCR Code of California Regulations
VOC Volatile organic compound

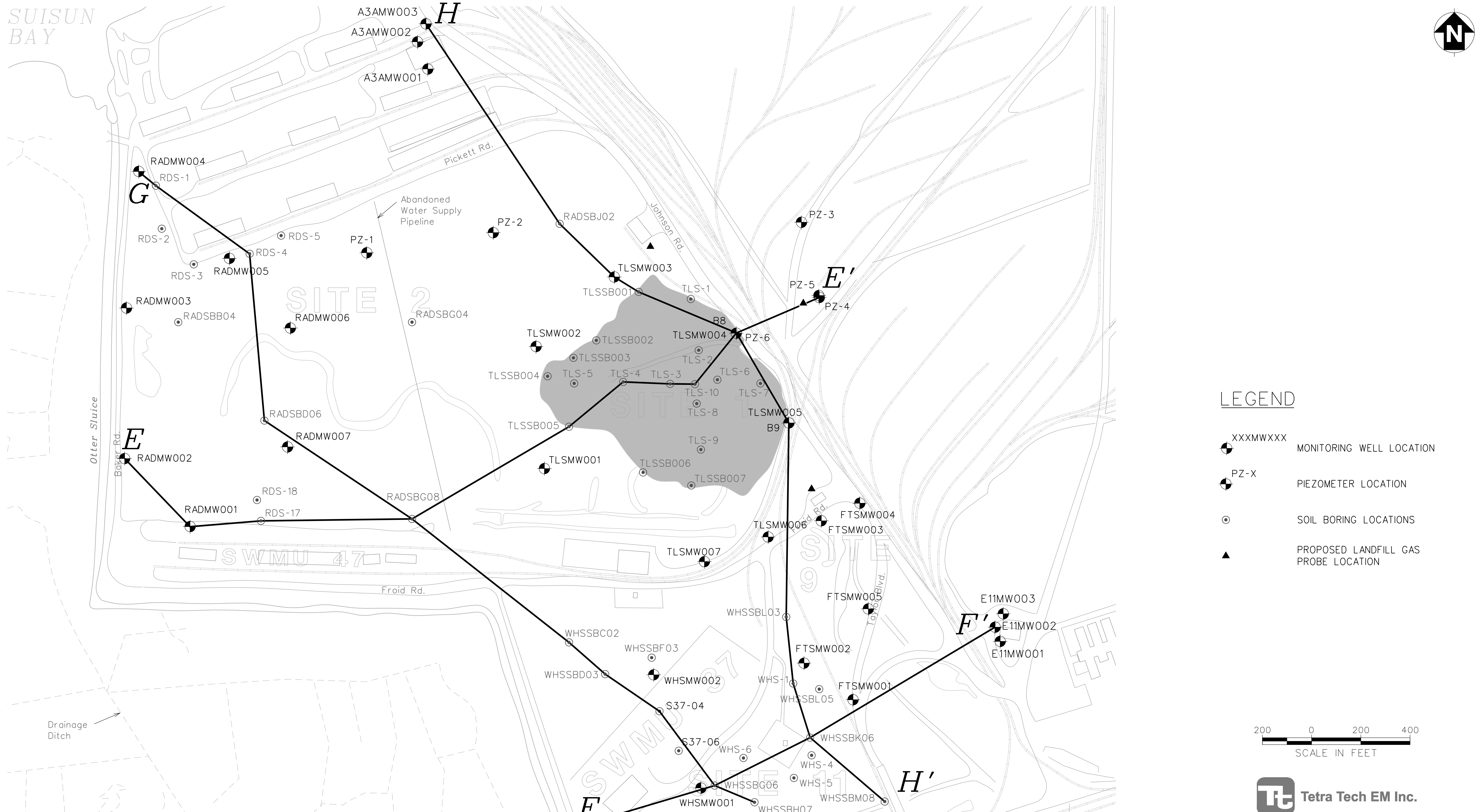


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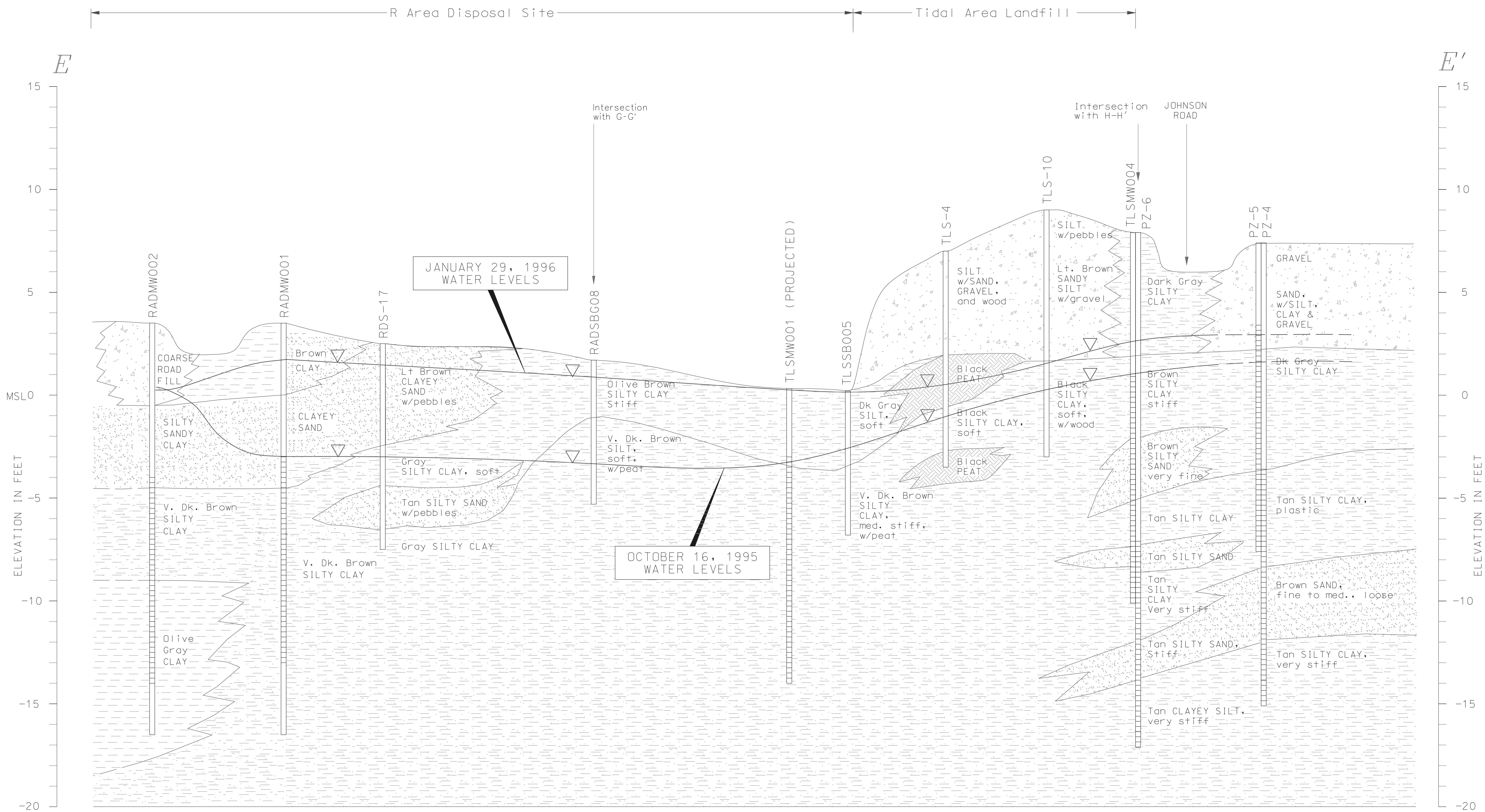
FIGURE 4
LOCATIONS OF GEOLOGIC
CROSS SECTIONS

1/17/2005 j:\concord1\dgn\Cto217\fig_4-1.dgn



1/17/2005 j:\concord\dgn\Cto217\Sections\sect_E-E_wl_2002.dgn

NOTES:

THIS CROSS SECTION REPRESENTS ONE ITERPRETATION BASED ON AVAILABLE DATA, OTHER INTERPRETATIONS ARE POSSIBLE

WATER LEVELS BETWEEN WELLS ARE INTERPOLATED

PROJECTED WELLS SHOW SCREENED INTERVALS BUT NOT LITHOLOGY

0 150 300
FEET
HORIZONTAL SCALE

VERTICAL SCALE = 20 X HORIZONTAL SCALE

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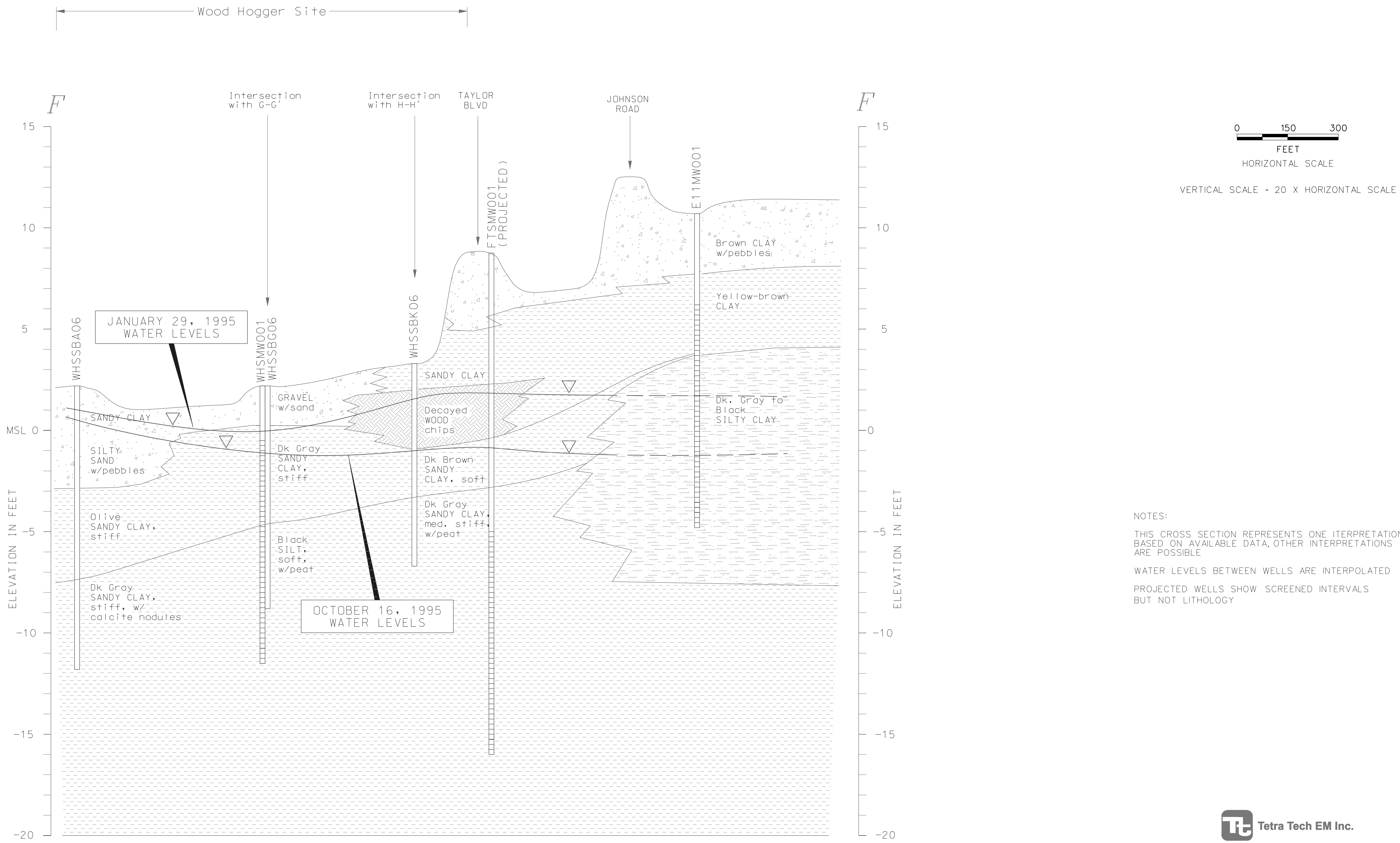
FIGURE 5
GROUNDWATER ELEVATIONS ALONG GEOLOGIC CROSS SECTION E-E'



NOTES:

THIS CROSS SECTION REPRESENTS ONE ITERPRETATION BASED ON AVAILABLE DATA, OTHER INTERPRETATIONS ARE POSSIBLE

WATER LEVELS BETWEEN WELLS ARE INTERPOLATED

PROJECTED WELLS SHOW SCREENED INTERVALS BUT NOT LITHOLOGY

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FIGURE 6
GROUNDWATER ELEVATIONS ALONG GEOLOGIC CROSS SECTION F-F'

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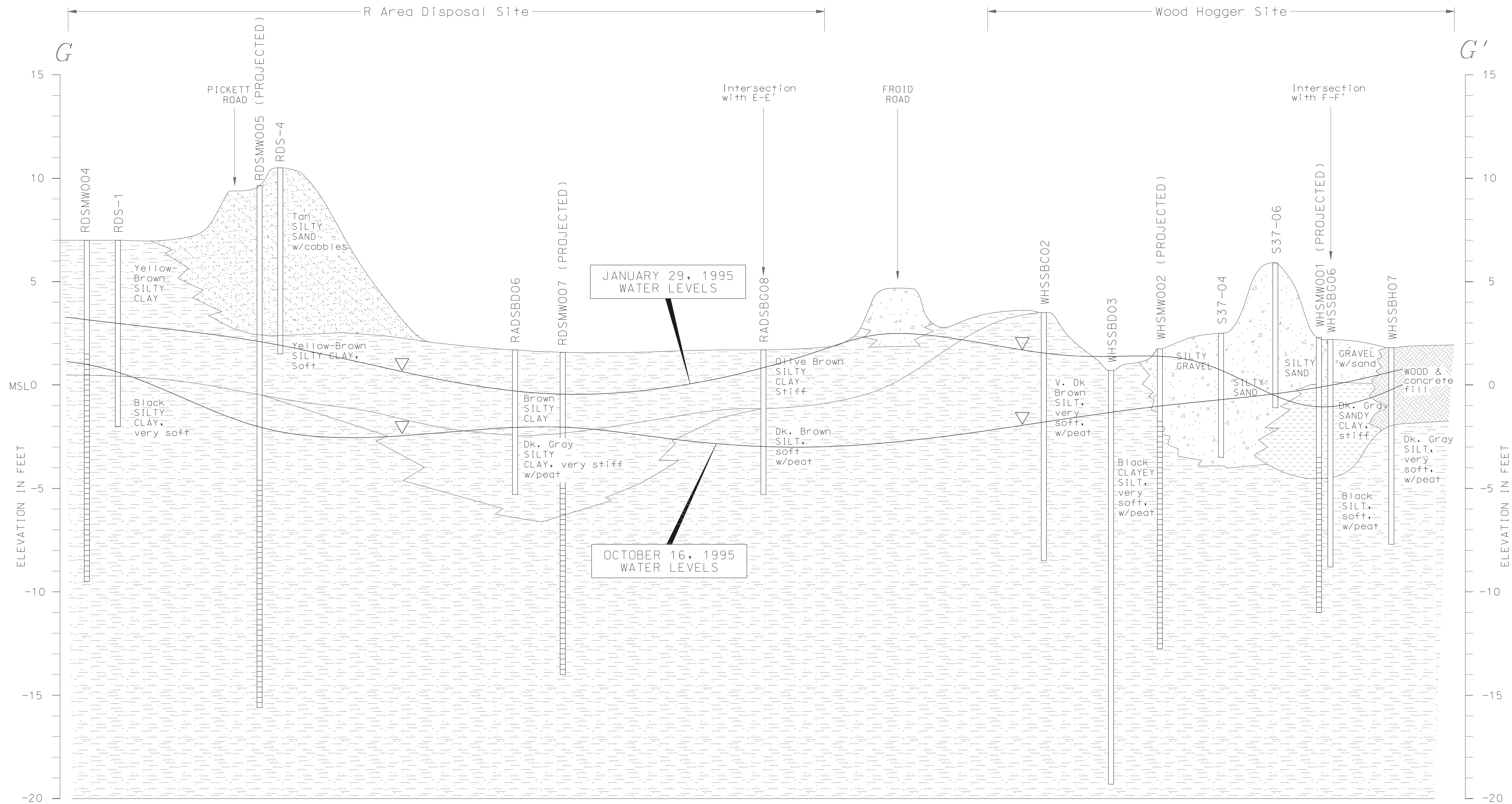

1/17/2005 j:\concord\dgn\Cto217\Sections\sect_G-G_wl.dgn

NOTES:

THIS CROSS SECTION REPRESENTS ONE ITERPRETATION BASED ON AVAILABLE DATA, OTHER INTERPRETATIONS ARE POSSIBLE

WATER LEVELS BETWEEN WELLS ARE INTERPOLATED

PROJECTED WELLS SHOW SCREENED INTERVALS BUT NOT LITHOLOGY

0 150 300
FEET
HORIZONTAL SCALE

VERTICAL SCALE = 20 X HORIZONTAL SCALE

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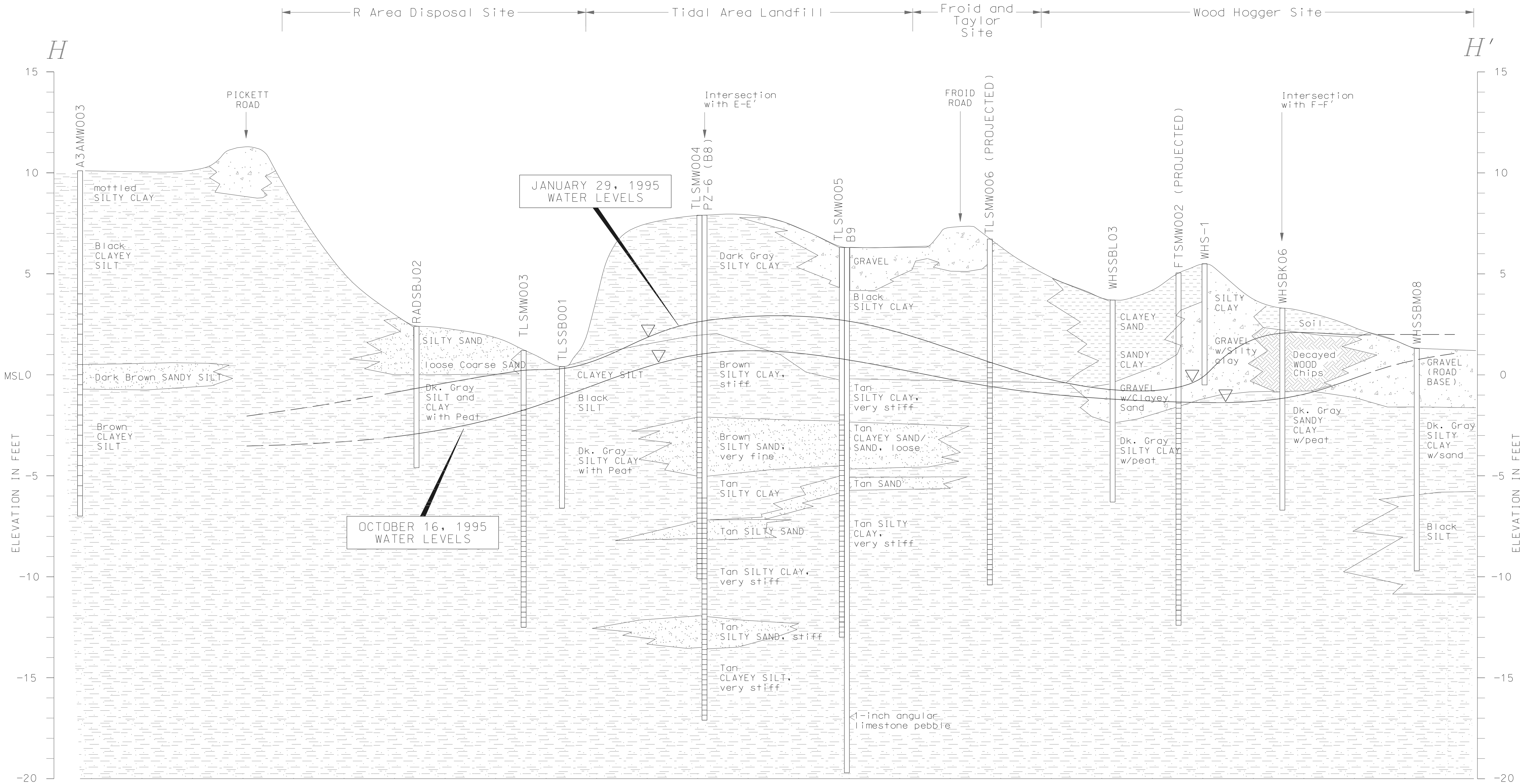
FIGURE 7
GROUNDWATER ELEVATIONS ALONG GEOLOGIC CROSS SECTION G-G'



NOTES:

THIS CROSS SECTION REPRESENTS ONE ITERPRETATION BASED ON AVAILABLE DATA, OTHER INTERPRETATIONS ARE POSSIBLE

WATER LEVELS BETWEEN WELLS ARE INTERPOLATED

PROJECTED WELLS SHOW SCREENED INTERVALS BUT NOT LITHOLOGY

0 150 300
FEET
HORIZONTAL SCALE

VERTICAL SCALE = 20 X HORIZONTAL SCALE

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FIGURE 8
GROUNDWATER ELEVATIONS ALONG GEOLOGIC CROSS SECTION H-H'

- Facility map showing the location and identification of each monitoring location.
- Boring log, including the lithologic descriptions, the northing and easting coordinates for the boring location, the name of the drilling contractor, and the name of the geologist responsible for logging the hole
- As-built drawings, including details of the probe materials, depths to filter packs and bentonite seals, materials used for backfill, lengths and locations of screened intervals, and description of shutoff valves.

The probes will be completed using 2-inch-diameter polyvinyl chloride casing, as shown on Figure 9. It is anticipated that the screen intervals will be 6 feet (GMP1 and GMP2) to 5 feet (GMP3). Screen intervals will be determined based on the depth of the permanent low seasonal water table and the minimum bentonite surface seal requirement of 2 feet bgs.

All LFG perimeter probes will be screened to assess whether LFG has migrated beyond the landfill. An LFG analyzer (such as a Lantec Gem 500 model or equivalent) will be used in the field to measure methane, oxygen, and carbon dioxide using the procedures provided by CIWMB, as contained in Appendix H. A portable hydrogen sulfide analyzer (Jerome 631-X or equivalent) will also be used for measuring levels of hydrogen sulfide. Individual samples will also be collected from the three probes with the highest concentrations above background and analyzed for VOCs using TO-15 and for fixed gases using ASTM D 1946. Samples will be analyzed at a fixed-facility laboratory.

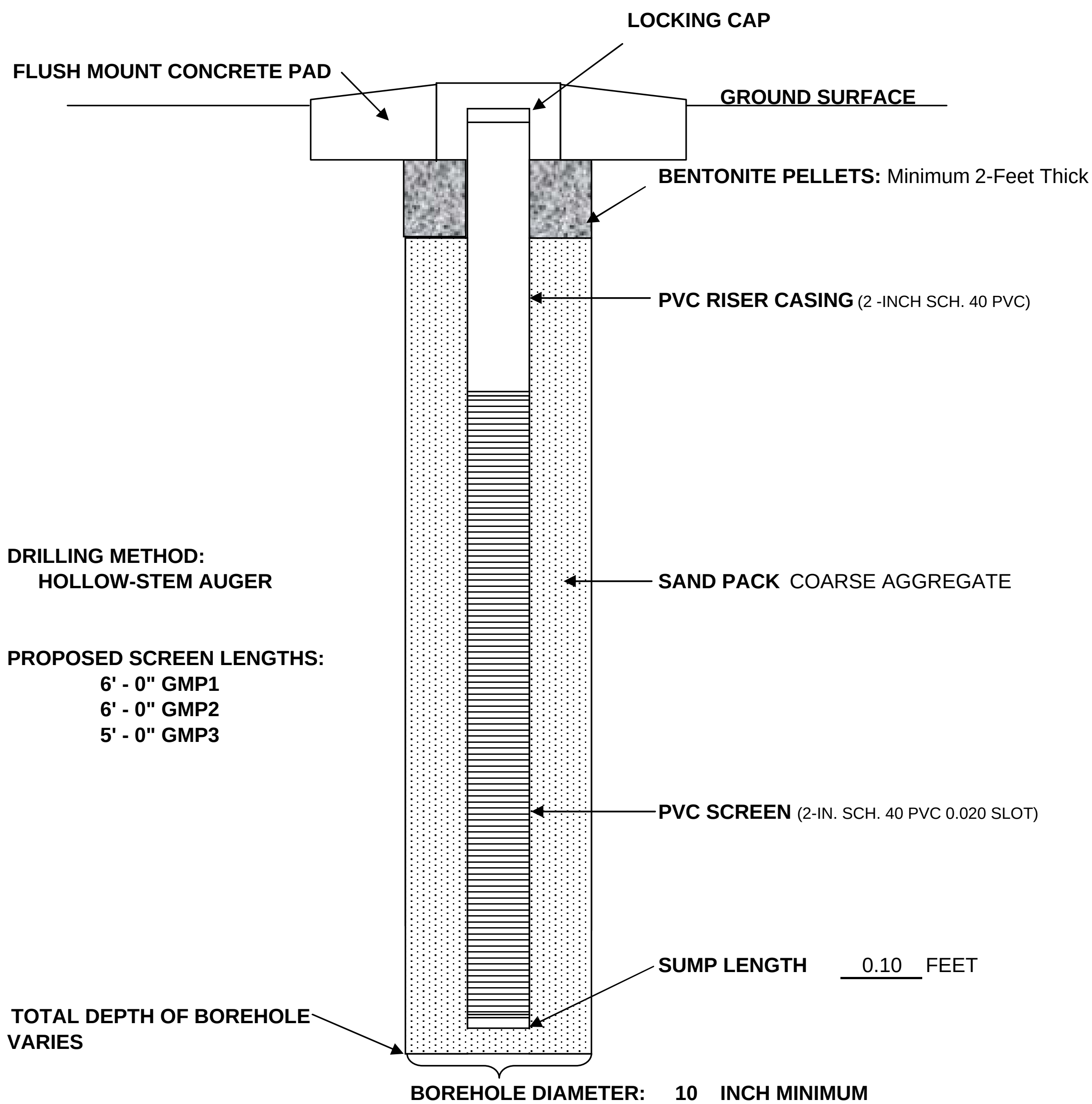
The locations for the perimeter LFG probe samples, the sample IDs, and the rationale for selecting these sample locations are presented in Table 8. The proposed sampling locations, which will be designated GMP1 through GMP3, are shown on Figure 2. Samples for chemical analysis will be submitted to California state-certified laboratories that have been approved by the Navy.

2.1.3 Rationale for Selecting Analytical Parameters

Analytical parameters were selected in accordance with *Testing Guidelines for Active Solid Waste Disposal Sites* (CARB 1986) and CIWMB guidelines.

2.1.4 Surveying

After the LFG monitoring probes have been installed, a professional land surveyor, licensed by the State of California, will provide the elevation of each boring to a precision of 0.10 foot and its horizontal location to 0.1 foot. The elevations will be surveyed relative to the 1929 National Geodetic Vertical Datum (1929 NGVD). The boring horizontal locations will be surveyed using the 1927 North American Datum (1927 NAD).



FT MSL=FEET MEAN SEA LEVEL

Tetra Tech EM Inc.

TIDAL AREA LANDFILL
NAVAL WEAPONS STATION SEAL BEACH
DETACHMENT CONCORD, CALIFORNIA
Integrated Product Team West, Daly City

FIGURE 9
TYPICAL LFG MONITORING PROBE COMPLETION DIAGRAM

2.1.5 Underground Utilities Survey

Underground utilities will be surveyed to clear all soil boring locations before any intrusive activities begin. The survey will include water distribution piping, telecommunications lines, storm sewer lines, sanitary sewer lines, industrial wastewater lines, gas lines, fire water lines, fuel product lines, and electrical lines.

2.1.6 Munitions and Explosives of Concern

The entire Tidal Area at Concord is located within an area suspected of containing MEC as a result of the explosion at the munitions handling docks in 1944. In addition, the area is suspect to contain MEC based on former reports of potential disposal of tritonal in the landfill. Consequently, the area must be investigated and cleared for potential MEC using magnetometer screening before invasive activities begin (such as drilling landfill gas perimeter monitoring probes).

2.2 SAMPLING METHODS

This section describes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of investigation derived waste.

2.2.1 Sampling Methods and Equipment

LFG will be field-screened at the surface of the landfill and locations of perimeter monitoring probes using an LFG analyzer (such as a Lantec Gem 500 model or equivalent) to measure methane, oxygen, and carbon dioxide. A portable hydrogen sulfide analyzer (Jerome 631-X or equivalent) will also be used to measure levels of hydrogen sulfide.

LFG samples for laboratory analysis will be contained in summa canisters, unless hydrogen sulfide is measured at a concentration that exceeds 10 ppm. If hydrogen sulfide is measured at a concentration exceeding 10 ppm, then the sample will be contained in a Tedlar bag. Table 8 presents the proposed identification numbers for LFG samples and the rationale for each sample location.

2.2.2 Decontamination

Hollow-stem auger equipment will be used for drilling landfill gas perimeter monitoring probes. Equipment, including augers and samplers and the back end of the rig, will be steam cleaned before work begins and between installation of each soil boring. Decontamination of the equipment will follow general practices listed in Tetra Tech SOP 002 (Appendix C). A portable steam cleaner and an on-site source of potable water will be used for decontamination, and all water derived from decontamination will be collected and temporarily stored on site for characterization. An on-site source of potable water for the steam cleaner will be available. No other equipment will require decontamination.

2.2.3 Management of Investigation-Derived Waste

No investigation-derived waste (IDW) will be generated during this investigation.

2.2.4 Sample Containers and Holding Times

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for samples prior to extraction and analysis are presented in Table 9.

2.3 SAMPLE HANDLING AND CUSTODY

The sections below describe procedures for sample handling, including sample identification and labeling, documentation, chain-of-custody, and shipping.

2.3.1 Sample Identification

A unique sample identification number will be assigned to each sample collected during this project. The sample identification numbering system is designed to be compatible with a computerized data management system that includes previous results for samples collected at this installation. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering system indicates the DO and site numbers, sampling type, and the location number. The numbering scheme is illustrated below.

DO	032
Site	1
Sampling Activity	TLSS – surface LFG sample GMP – LGF monitoring probe sample
Specific Sample Location	Specific sample locations will be numbered consecutively for each specific sampling activity
Sample Depth	Not required for LGF sampling

For example, the LFG sample collected from GMP1 under DO 032 at Site 1 will be designated 032GMP1.

TABLE 9: ANALYTICAL PROTOCOL FOR GAS CHARACTARIZATION

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analysis	Method	Matrix	Holding Time (From Date Sampled)	Container	Preservative
Volatile Organic Compounds	EPA TO-15	Air	30 days for Summa canister 72 hours for Tedlar bag	Summa canister or Tedlar bag	None
Landfill Gases	ASTM D 1946	Air	30 days for Summa canister 72 hours for Tedlar bag	Summa canister or Tedlar bag	None

Notes:

ASTM American Society for Testing and Materials
EPA U.S. Environmental Protection Agency
TO Toxic organic

Source: EPA. 1999a.

2.3.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information, written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After it is labeled, each soil sample will be refrigerated or placed in a shipping container designed for Summa canisters.

2.3.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Tetra Tech personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink
- All entries will be legible
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout
- Any serialized documents will be maintained at Tetra Tech and referenced in the site logbook
- Unused portions of pages will be crossed out, and each page will be signed and dated

Section 1.6.1 includes additional information on how Tetra Tech will use logbooks to document field activities. The field team leader (FTL) is responsible for ensuring that sampling activities are properly documented.

2.3.4 Chain of Custody

The contractor will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record (Appendix D) also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins when samples are received and continues until samples are discarded. Laboratories analyzing samples must follow custody procedures at least as stringent as are required by the EPA CLP SOWs (EPA 1999b, 2000a). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons who delivered the samples, the date and time they were received, condition of the sample at the time it was received (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. This information should be entered into a computerized LIMS. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples that require special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

2.3.5 Sample Shipment

The following procedures (also outlined in SOP No. 074) will be implemented when samples collected during this project are shipped:

- The shipping container designed for Summa canisters will be filled with packing material to prevent samples from damage during shipment.
- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the shipping container. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The shipping container will be closed and taped shut with strapping tape around both ends. If the shipping container has a drain, it will be taped shut both inside and outside of the shipping container.
- Signed and dated custody seals will be placed on the front and side of each shipping container. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported within the taped sealed shipping container. When the shipping container is received at the analytical laboratory, laboratory personnel will open the shipping container and sign the chain-of-custody record to document transfer of samples.

Multiple shipping containers may be sent in one shipment to the laboratory. The outside of the shipping container will be marked to indicate the number of shipping container in the shipment.

2.4 ANALYTICAL METHODS

Gaseous samples will be analyzed for VOCs by full-scan gas chromatography/mass spectrometry (GC/MS) method EPA TO-15. A sample aliquot will be withdrawn from the whole air sample in the Summa canister or Tedlar bag and passed through a mass flow controller, and then either cryofocused by liquid argon or concentrated using a multisorbent bed. The focused air will then be flash-heated through a hydrophobic drying system that removes water from the sample stream before analysis by GC/MS. EPA Method TO-15 will quantitate and speciate the standard VOCs. The samples will also be analyzed for fixed gases using ASTM D 1946.

Sample volume, preservation, and holding time requirements for these methods are specified in Table 9. Appendix A includes project-specific precision and accuracy goals for the methods. Finally, Appendix E documents the project-required reporting limits (PRRL) for this project.

The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. If problems occur in achieving the PRRLs, the laboratories will contact the contractor analytical coordinator immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the MDL will be reported with appropriate flags to indicate the greater uncertainty associated with these values.

Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following sections.

2.4.1 Selection of Analytical Laboratories

Laboratories for this investigation will be selected from a list of prequalified laboratories developed by Tetra Tech to support Navy contracts. Prequalification streamlines laboratory selection by reducing the need to compile and review detailed bid and qualification packages for each individual investigation. Prequalification also improves flexibility in the program by allowing analyses to be directed to a number of different capable laboratories with available capacity at the time samples are collected.

Tetra Tech's laboratory prequalification and selection process relies on (1) a standard procedure to evaluate and prequalify laboratories for work under the contract, and (2) the "Tetra Tech EM Inc. Laboratory Analytical Statement of Work" for Navy contracts (Tetra Tech 2002), a contractual document that specifies standard requirements for analyses that are routinely conducted. Tetra Tech establishes a basic ordering agreement that incorporates and enforces the laboratory SOW with each prequalified laboratory. Individual purchase orders can then be written for specific investigations. These aspects of laboratory selection are further described in the following sections, along with Tetra Tech's procedures for selecting laboratories when the laboratory SOW does not specifically address project-specific analytical methods or QC requirements.

2.4.1.1 Laboratory Evaluation and Prequalification

Laboratories that support the Navy either directly or through subcontracts are evaluated and approved for Navy use by the Naval Facilities Engineering Service Center (NFESC). Laboratories that support Tetra Tech under Navy contracts have been selected from the list of laboratories approved by NFESC. They further have been evaluated by Tetra Tech to assure that the laboratory can meet the technical requirements of the laboratory SOW and produce data of acceptable quality. The laboratories are evaluated in accordance with the NFESC *Installation Restoration Chemical Data Quality Manual* (IRCDQM) (NFESC 1999). The laboratory evaluation includes the following elements:

- **Certification and approval.** Laboratories must be currently certified by the California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified. Laboratories must also have or obtain similar approval from NFESC. The California DHS ELAP certification and NFESC approval must be obtained before the laboratory begins work.

- **Performance evaluation (PE) samples.** Each laboratory must initially and yearly demonstrate its ability to satisfactorily analyze single-blind PE samples for all analytical services it will provide under Navy contracts. At its discretion, Tetra Tech may submit one or more double-blind PE samples at Tetra Tech's cost. When the results for the PE sample are deficient, the laboratory must correct any problems and analyze (at its own cost) a subsequent round of PE samples for the deficient analysis.

- **Audits.** Laboratories must initially and yearly demonstrate their qualifications by submitting to one or more audits by Tetra Tech. The audits may consist of (1) an on-site review of laboratory facilities, personnel, documentation, and procedures, or (2) an off-site review of hardcopy and electronic deliverables, or magnetic tapes. When deficiencies are identified, the laboratory must correct the problem and provide Tetra Tech with a written summary of the corrective action that was taken.

Appendix F provides a current list of subcontractor laboratories that have passed this evaluation program. Each laboratory was evaluated before it was added to the list, and each is reevaluated annually. If a laboratory fails to meet any of the evaluation criteria, it is removed from the list of approved laboratories.

2.4.1.2 Laboratory Statement of Work

The laboratory SOW establishes standard requirements for the analytical methods that are most commonly used under Navy contracts. For each method, the laboratory SOW specifies standard method-specific target analyte lists and PRRLs; QC samples and associated control limits; calibration requirements; and miscellaneous method performance requirements. The laboratory SOW also specifies requirements for standard data packages, formats for EDDs, data qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, temperature blanks, sample coolers, and custody forms and seals) that are expected of laboratories. The laboratory SOW incorporates Navy QA policy, as well as applicable EPA and state QA guidelines, as appropriate.

Tetra Tech's laboratory SOW is based on EPA CLP methods for volatile organic compounds, SVOCs, pesticides, PCBs, metals, and cyanide. The laboratory SOW also addresses frequently used non-CLP methods for a variety of organic, inorganic, and physical parameters. Non-CLP methods include the methods published by EPA in SW-846 and in "Methods for Chemical Analysis of Water and Waste" (MCAWW); ASTM methods; and those published by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation in "Standard Methods for the Examination of Water and Waste Water." Laboratories on Tetra Tech's approved laboratory list can elect to provide all or a portion of the analytical services specified in the laboratory SOW.

As noted above, the laboratory SOW is incorporated into all laboratory subcontracts established for analytical services supporting Navy projects. Thus, the prequalified laboratories commit to meeting the requirements in the laboratory SOW during the contracting process before they receive samples. Tetra Tech reviews and revises the laboratory SOW regularly to incorporate new methods and requirements, modifications or updates to existing methods, changes in Navy QA policy or regulatory requirements, and any other necessary corrections or revisions.

2.4.1.3 Laboratory Selection and Oversight

After project-specific analytical and QA/QC requirements have been identified and documented in the SAP, the Tetra Tech analytical coordinator works closely with a Tetra Tech procurement specialist to select a laboratory that can meet these requirements. When project-specific analytical and QC requirements are consistent with Tetra Tech's laboratory SOW, the analytical coordinator identifies one or more prequalified subcontractor laboratories that are capable of carrying out the work. As part of this process, the analytical coordinator typically contacts the laboratories to discuss the analytical requirements and project schedule. The analytical coordinator then forwards the name of the recommended laboratory (or laboratories) to the Tetra Tech procurement specialist, who issues a purchase order for the work. When analytical requirements are consistent with Tetra Tech's laboratory SOW and multiple prequalified laboratories are capable of performing the work, a specific laboratory is typically selected based on workload and project schedule considerations.

Tetra Tech follows a similar procedure when project-specific analytical and QC requirements are nonstandard and differ from Tetra Tech's laboratory SOW. The analytical coordinator contacts analytical laboratories, beginning with Tetra Tech's prequalified list, to discuss the analytical and QA/QC requirements in the SAP and to assess the laboratories' ability to meet the requirements. In many cases, Tetra Tech works cooperatively with analytical laboratories to develop and refine appropriate QC requirements for nonstandard analyses or matrixes.

Additional laboratories are contacted if the analytical coordinator is unable to identify one or more prequalified laboratories that can perform the work. In general, the additional laboratories must be evaluated as described in Section 2.4.1.1 before they will be allowed to analyze any samples, although some steps in the evaluation may be waived for certain investigations and circumstances (for example, unusual analytes, urgent project needs, experimental methods, mobile laboratories, or on-site screening analyses). After additional laboratories have been identified, the analytical coordinator forwards their names to the procurement specialist. The procurement specialist prepares a solicitation package, including the project-specific analytical and QC requirements, and submits the package to the laboratories. The procurement specialist, in cooperation with the analytical coordinator and project manager, then evaluates the proposals that are received and selects a laboratory that meets the requirements and provides the best value to the Navy and Tetra Tech. Finally, the procurement specialist issues a purchase order to the selected laboratory that incorporates the project-specific analytical and QA/QC requirements.

After a laboratory has been selected, the analytical coordinator holds a kickoff meeting with the laboratory project manager. The kickoff meeting is held regardless of whether project-specific analytical and QA/QC requirements are consistent with Tetra Tech's laboratory SOW or are outside the SOW. The Tetra Tech project manager, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

2.4.2 Project Analytical Requirements

One or more prequalified subcontractor laboratories will analyze gaseous samples off site for this investigation. The laboratories will be selected before the field program begins based on their ability to meet the project analytical and QC requirements, as well as their ability to meet the project schedule. The analytical methods selected for this investigation standard EPA methods that are described in Tetra Tech's laboratory SOW.

This SAP documents project-specific QC requirements for the analytical methods selected. Sample volume, preservation, and holding time requirements are specified in Table 9. Requirements for laboratory QC samples are described in Table 5 and in Section 2.5. Appendix A includes project-specific precision and accuracy goals for the methods. Finally, PRRLs for each method are documented in Appendix E.

2.5 QUALITY CONTROL

The precision and accuracy of the chemical measurements of gas samples in Summa canisters or Tedlar bags will be assessed through a combination of field and laboratory QC samples. Field QC samples and laboratory QC samples are discussed in the following sections.

2.5.1 Field Quality Control Samples

Field Duplicate Samples: Duplicate samples will be collected to evaluate field sampling precision. One field duplicate sample will be collected and analyzed for every 10 samples collected during the investigation. The sample will be collected using a "Y" splitter attached to two separate 6-liter Summa canisters or Tedlar bags. Duplicates are assigned nondescript sample ID numbers and are submitted blind to the laboratory.

Canister Trip Blanks: One canister trip blank (filled with ultra high purity nitrogen) will be included with the samples shipped to the laboratory for analysis to evaluate sample integrity during transport.

2.5.2 Laboratory Quality Control Samples

The following types of laboratory QC samples will be used for this investigation:

- **Method blanks** will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

- **LCS** will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to determine the usability of the data.

- **Surrogate standards** consist of known concentrations of nontarget organic analytes that are added to each sample and method blank before samples are prepared and analyzed. The surrogate standard measures the efficiency of the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed by GC for volatile and extractable organic constituents.

- **Canister blanks** will be submitted for analysis to evaluate the cleaning of the Summa canisters by the laboratory.

2.5.2.1 Additional Laboratory QC Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed below.

- **MDL Studies** determine the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL accounts for sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all air analyses. MDL studies will be conducted annually for soil matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than the required quantitation limits. The replicates will be extracted and analyzed in the same manner as the routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

- **Sample Quantitation Limits** (SQL) or practical quantitation limits, are PRRLs adjusted for the characteristics of individual samples. The PRRL is usually defined in the analytical method or in laboratory method documentation. The SQL accounts for changes in preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.
- **Control Charts:** Control charts document data quality in graphic form for specific method parameters such as surrogate standards and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Control charts are recommended for organic analyses. At a minimum, method blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Control charts should be updated monthly.

2.5.3 Monitoring Frequency

This one time sampling event will be conducted to provide data for the design of the LFG vents on the final cover of the landfill and to ensure that methane concentrations do not exceed the LEL of 5 percent by volume (50,000 ppmv) in soil at the compliance boundary and that trace gases are controlled to prevent adverse exposure to toxic or carcinogenic compounds.

Because samples of landfill gas will be collected in Summa canisters or Tedlar bags only based on field screening data for VOCs, the frequency that landfill gas will be submitted for laboratory analysis is unknown.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in the equipment manufacturer's literature or operating manual. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The FTL will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. When the condition of equipment is suspect, unscheduled testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this investigation. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures; the frequency and type of maintenance performed; and procedures for documenting maintenance.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Calibration procedures are discussed in Appendix C in the SOP for conducting soil gas investigations. Calibration procedures ensure the accuracy of measurements made using field and laboratory equipment.

2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Tetra Tech project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete Navy projects and are responsible for determining acceptance criteria for these items.

Supplies and consumables can be received either at the Tetra Tech office or at the site. When supplies are received, the project manager or FTL will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order, and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers" (EPA 1992).

2.9 NONDIRECT MEASUREMENTS

No data for project implementation or decision-making will be obtained from nondirect measurement sources.

2.10 DATA MANAGEMENT

Field and analytical data collected from this project and other environmental investigations at NWS SBD Concord are critical to site characterization efforts, development of the comprehensive conceptual site model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into Tetra Tech's database for NWS SBD Concord. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, (3) using with geographic information systems (GIS), and (4) transmitting in an electronic format compatible with NEDTS. The following sections describe Tetra Tech's data tracking procedures, data pathways, and overall data management strategy for NWS SBD Concord.

2.10.1 Data Tracking Procedures

All data that are generated in support of the Navy program at NWS SBD Concord are tracked through a database created by Tetra Tech. Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in the Tetra Tech program, SAMTRAK. All data are filed according to the document control number.

2.10.2 Data Pathways

Data are generated from three primary pathways at NWS SBD Concord: data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the database for NWS SBD Concord. Data pathways must be established and well documented to evaluate whether the data have been accurately loaded into the database in a timely manner.

Data generated during field activities are recorded using field forms (Appendix D). The analytical coordinator or FTL reviews these forms for completeness and accuracy. Data from the field forms, including the chain-of-custody form, are entered into SAMTRAK according to the document control number.

Data generated during laboratory analysis are recorded in hardcopy and in EDDs after the samples have been analyzed. The laboratory will send the hardcopy and EDD records to the analytical coordinator. The analytical coordinator reviews the data deliverable for completeness, accuracy, and format. After the format has been approved, the electronic data are manipulated and downloaded into the Concord database. Tetra Tech data entry personnel will then update SAMTRAK with the total number of samples received and number of days required to receive the data.

After validation, the analytical coordinator reviews the data for accuracy. Tetra Tech will then update the Concord database with the appropriate data qualifiers. SAMTRAK is also updated to record associated laboratory and data validation costs.

2.10.3 Data Management Strategy

Tetra Tech's short- and mid-term data management strategies require that the database for NWS SBD Concord be updated monthly. The data consist of chemical and field data from Navy contractors, entered into an Oracle (Version 7.3) database. The database can be used to generate reports using available computer-aided drafting and design and contouring software. All electronic data from this database will be stored and maintained in a format compatible with NEDTS.

To satisfy long-term data management goals, the data will be loaded into the database at Tetra Tech for storage, further manipulation, and retrieval after laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms (Appendix D) that are reviewed for completeness and accuracy by the analytical coordinator or FTL. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at Tetra Tech or Navy offices. Laboratories that generated the data will archive hardcopy data for a minimum of 10 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to Tetra Tech and Navy management.

3.1 Assessment and Response Actions

Tetra Tech and the Navy will oversee collection of environmental data using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, Tetra Tech and Navy responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

3.1.1 Field Assessments

Tetra Tech conducts field technical systems audits (TSA) on selected Navy projects to support data quality and encourage continuous improvement in the field systems that involve environmental data collection. The Tetra Tech QA program manager selects projects for field TSAs quarterly based on available resources and the relative significance of the field sampling effort. During the field TSA, the assessor will use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in the approved SAP are being implemented. Specific items that may be observed during the TSA include:

- Availability of approved project plans such as the SAP and HASP
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

During the TSA, the Tetra Tech assessor will verbally communicate any significant deficiencies to the FTL for immediate correction. These and all other observations and comments will also be documented in a TSA report. The TSA report will be issued to the Tetra Tech project manager, FTL, program QA manager, and project QA officer in electronic (e-mail) format within 7 days after the TSA is completed.

The Tetra Tech program QA manager determines the timing and duration of TSAs. Generally, TSAs are conducted early in the project so that any quality issues can be resolved before large amounts of data are collected.

The Navy QA officer may also independently conduct a field assessment of any Tetra Tech project. Items reviewed by the Navy QA officer during a field assessment may be similar to those described above.

3.1.2 Laboratory Assessments

As described in Section 2.4.1, NFESC assesses all laboratories before they are allowed to analyze samples under Navy contracts. Tetra Tech also conducts a pre-award assessment of each laboratory before they are placed on the approved list for performing work under Navy contracts (Appendix F). These assessments include (1) reviews of laboratory certifications, (2) initial and annual demonstrations of the laboratory's ability to satisfactorily analyze single-blind PE samples, and (3) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures, or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements. Tetra Tech also conducts an assessment when an approved laboratory has been selected for nonroutine analyses or when a laboratory that is not on the approved list must be used.

Tetra Tech will conduct a TSA of the selected laboratory for this project after the laboratory receives and begins processing samples. The purpose of this TSA will be to review the project-specific implementation of the methods specified in this SAP and to ensure that appropriate QC procedures are being implemented in association with these methods.

The Navy may audit any laboratory that will analyze samples on this project. The Navy QA officer will determine the need for these audits and typically will conduct the audits before samples are submitted to the laboratory for analysis.

3.1.3 Assessment Responsibilities

Tetra Tech personnel who conduct assessments will be independent of the activity evaluated. The Tetra Tech program QA manager will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the program QA manager, project QA officer, or senior technical staff with relevant expertise and experience in assessment.

When an assessment is planned, the Tetra Tech program QA manager selects a lead assessor who is responsible for:

- Selecting and preparing the assessment team
- Preparing an assessment plan
- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated
- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions.

After a TSA is completed, the lead assessor will submit an audit report to the Tetra Tech program QA manger, project manager, and project QA officer; other personnel may be included in the distribution as appropriate. Findings from the assessment will also be included in the quality control summary report for the project (Section 3.2.3).

The Navy QA officer is responsible for coordinating all audits that may be conducted by Navy personnel under this project. Audit preparation, completion, and reporting responsibilities for Navy auditors would be similar to those described above.

3.1.4 Field Corrective Action Procedures

Field corrective action procedures will depend on the type and severity of the finding. Tetra Tech classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described in Section 3.1.1, project teams are required to respond to deficiencies identified in TSA reports. The project manager, FTL, and project QA officer will discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the Navy of the problem and the corrective action taken

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for selecting and implementing the corrective action, and the completion dates for each corrective action. The project QA officer will use a status report to monitor all corrective actions.

The Tetra Tech program QA manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The program QA manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The program QA manager can also request the reanalysis of any or all samples and a review of all data acquired since the system was last in control.

3.1.5 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the Tetra Tech analytical coordinator within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the Tetra Tech analytical coordinator. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. Tetra Tech will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

Tetra Tech will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, Tetra Tech and subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the FTL and submitted to the project manager and to the Navy Remedial Project Manager (RPM), if requested. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Monthly Status Report

The Tetra Tech project manager will prepare a monthly status report (MSR) to be submitted to the Tetra Tech's program manager and the Navy RPM. Monthly status reports address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, Tetra Tech will obtain similar information from subcontractors who are participating in the project and will incorporate the information within the MSR.

3.2.3 Quality Control Summary Report

Tetra Tech will prepare a QC summary report (QCSR) that will be submitted to the Navy RPM with the final report for the field investigation. The QCSR will include a summary and evaluation of QA/QC, including any field or laboratory assessments, completed during the investigation. The QCSR will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining defensible data of acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called “outliers.” A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An independent third-party contractor will validate all laboratory data in accordance with current EPA national functional guidelines (EPA 1994, 1999c). The data validation strategy will be consistent with Navy guidelines. For this project, 90 percent of the data for contaminants of concern will undergo cursory validation and 10 percent of the data for contaminants of concern will undergo full validation. Requirements for cursory and full validation are listed below.

4.1.3.1 Cursory Data Validation

Cursory validation will be completed on 90 percent of the summary data packages received. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

4.1.3.2 Full Data Validation

Full validation will be completed on 10 percent of the full data packages received. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries.

4.1.3.3 Data Validation Criteria

Table 10 lists the QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from Table 10 will be consistent with the project-specific analytical methods referenced in Section 2.4 of the SAP.

TABLE 10: DATA VALIDATION CRITERIA

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analytical Parameter Group	Cursory Data Validation Criteria	Full Data Validation Criteria
Non-CLP Organic Analyses	Method compliance	Method compliance
	Holding times	Holding times
	Calibration	Calibration
	Blanks	Blanks
	Surrogate recovery	Surrogate recovery
	Laboratory control sample or blank spike	Laboratory control sample or blank spike
	Field duplicate sample analysis	Compound identification
	Other laboratory QC specified by the method	Detection limits
	Overall assessment of data for an SDG	Compound quantitation
		Sample results verification
		Other laboratory QC specified by the method
		Overall assessment of data for an SDG

Notes:

CLP Contract Laboratory Program
QC Quality control
SDG Sample delivery group

4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met.

To the extent possible, Tetra Tech will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (EPA 2000c). The DQA process includes five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative, Tetra Tech will systematically assess data quality and data usability. This assessment will include:

- A review of the sampling design and sampling methods to verify that they were implemented as planned and are adequate to support project objectives
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met
- A review of project-specific DQOs to determine whether they have been achieved by the data collected
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared with a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

REFERENCES

California Air Resources Board (CARB). 1986. "Testing Guidelines for Active Solid Waste Disposal Sites."

Ecology and Environment (E&E). 1983. "Initial Assessment Study of Naval Shipyard, Mare Island, Vallejo, California." Prepared for Navy Assessment and Control of Installation Pollutants Department. March.

Naval Facilities Engineering Service Center (NFESC). 1999. "Navy Installation Restoration Chemical Data Quality Manual (IRCDQM)." Special Report SP-2056-ENV. September.

Occupational Safety and Health Administration (OSHA). 2003. "U.S. Department of Labor Occupational Safety and Health Administration, Permissible Exposure Limits," http://www.osha.gov/SLTC/pel. July.

PRC Environmental Management, Inc. (PRC). 1994. "Draft Final Work Plan, Volume I, Remedial Investigation/Feasibility Study [RI/FS] Tidal Area Sites, Naval Weapons Station Concord, California." December.

PRC. 1995. "RI/FS Tidal Area Sites Draft Final Work Plan, Volume II (QEA), Naval Weapons Station Concord, California." February.

PRC and Montgomery Watson (MW). 1993. "Tidal Area Landfill Confirmation Sampling Study, Naval Weapons Station, Concord, California."

Tetra Tech EM Inc. (Tetra Tech). 1998. "Technical Memorandum: Confirmation Groundwater Sampling in the Tidal Area Sites - Naval Weapons Station, Concord, California." March 19.

Tetra Tech. 2002. "Tetra Tech EM Inc. Laboratory Analytical Statement of Work." January.

Tetra Tech. 2003. John Bosche personal communication with Donald R. Ford. September 9.

Tetra Tech. 2004. "Final Record of Decision, Tidal Area Landfill Naval Weapons Station Seal Beach Detachment Concord, California." March

U.S. Environmental Protection Agency (EPA). 1992. "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers." OSWER Directive No. 9240.0-05A. April.

EPA. 1993. "Presumptive Remedy for CERCLA Municipal Landfill Sites." EPA 540/F-93/035. September.

EPA. 1994. "National Functional Guidelines for Inorganic Data Review." Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-94/013. February.

EPA. 1999a. “Compendium Method TO-15, Determination of Volatile Organic Compounds in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).” January.

EPA. 1999b. “U.S. EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration.” Document Number OLM04.2. May.

EPA. 1999c. “National Functional Guidelines for Organic Data Review.” Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-99-008. October.

EPA. 2000a. “U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration.” Document Number ILM04.1. January.

EPA. 2000b. “Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/ G-4HW).” Office of Environmental Information. Washington, D.C. EPA/600/R-00/007. January.

EPA. 2000c. “Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/ G-9, QA00 Update.” Office of Environmental Information. Washington, D.C. EPA/600/ R-96-084. July.

EPA. 2000d. “Guidance for the Data Quality Objectives Process, EPA QA/G-4.” Office of Environmental Information. Washington, DC. EPA/600/R-96/055. August.

EPA. 2001. “EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5.” Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

APPENDIX A
METHOD PRECISION AND ACCURACY GOALS

TABLE A-1: PRECISION AND ACCURACY GOALS FOR LANDFILL GAS SAMPLES

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analyte	Air	
	% Recovery	RPD
EPA Method TO-15		
Chloromethane	70-130	25
Vinyl Chloride	70-130	25
Chloroethane	70-130	25
1,1-Dichloroethene	70-130	25
1,1-Dichloroethane	70-130	25
cis-1,2-Dichloroethene	70-130	25
1,1,1-Trichloroethane	70-130	25
Benzene	70-130	25
1,2-Dichloroethane	70-130	25
Trichloroethene	70-130	25
Toluene	70-130	25
1,1,2-Trichloroethane	70-130	25
Tetrachloroethene	70-130	25
Ethylbenzene	70-130	25
m,p-Xylene	70-130	25
o-Xylene	70-130	25
1,1,2,2-Tetrachloroethane	70-130	25
1,3-Dichlorobenzene	70-130	25
1,4-Dichlorobenzene	70-130	25
1,2-Dichlorobenzene	70-130	25
trans-1,2-Dichloroethene	60-140	25
Naphthalene	60-140	25
Toluene-d_8	70-130	NA
Bromofluorobenzene	70-130	NA
1,2-Dichloroethane-d_4	70-130	NA
Miscellaneous Gases, ASTM D 1946		
Nitrogen	75-125	25
Oxygen	75-125	25
Carbon dioxide	75-125	25
Carbon monoxide	75-125	25
Methane	75-125	25
Ethane	75-125	25

TABLE A-1: PRECISION AND ACCURACY GOALS FOR LANDFILL GAS SAMPLES (Continued)

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analyte	Air	
	% Recovery	RPD
Miscellaneous Gases, ASTM D 1946 (Continued)		
Propane	75-125	25
n-Butane	75-125	25
Isobutane	75-125	25
n-Pentane	75-125	25
Isopentane	75-125	25
NMOC (C6+)	75-125	25

Notes:

%	Percent
ASTM	American Society for Testing and Materials
EPA	U.S. Environmental Protection Agency
NA	Not applicable; analyte is a system monitoring compound
NMOC (C6+)	Nonmethane organic carbon (C6 and heavier compounds)
RPD	Relative percent difference
TO	Toxic organics

APPENDIX B
SITE-SPECIFIC HEALTH AND SAFETY PLAN (SHORT FORM)

Site Name: Concord Naval Weapons Station	**Site Contact:** John Bosche	**Telephone:** (415) 222-8295
Location: Tidal Area Landfill (Site 1)	**Client Contact:** Steve Tyahla	**Telephone:** (650) 746-7451
EPA I.D. No.: Not applicable	**Prepared By:** David Foley	**Date:** April 2004
Project No. G1058.1.1.01.032.02	**Date of Proposed Activities:** Spring 2004	

Objectives:

All personnel working on this site must be trained in accordance with 29 CFR 1910.120 and must have medical clearance to work on a hazardous waste site.

The objective of this short form health and safety plan (HASP) is to list the site-specific hazards and the hazards controls to be used to ensure worker safety for the activities described below.

Site Type: *Check as many as applicable.*

☐ Active	☐ Industrial Waste	☐ Well field
☒ Inactive	☒ Landfill	☐ Underground storage tank
☒ Secure	☐ Confined space **(must use long form)**	☐ Unknown **(must use long form)**
☐ Unsecure	☐ Uncontrolled Waste **(must use long form)**	☐ Other *(specify)* ________________

Site Description/History and Site Activities:

The objective of the scope of work is to characterize landfill gas (LFG) emissions at the surface of the landfill and at perimeter monitoring probe locations. Future installation of LFG probes will be contingent on an evaluation of munitions and explosives of concern (MEC) at the site and is not detailed in this HASP. The Tidal Area at Naval Weapons Station Seal Beach Detachment (NWS SBD) Concord is located within an area suspected of containing MEC as a result of an explosion in 1944, at the munitions handling docks. In addition, former reports of potential disposal of tritonal (80 percent trinitrotoluene and 20 percent aluminum powder) in the landfill have resulted in the area being suspected of potentially containing MEC. Consequently, the area must be investigated and cleared for potential MEC using magnetometer screening prior to invasive activities (such as drilling for the installation of LFG perimeter monitoring probes). The LFG characterization data will be used to evaluate whether any LFG control (active or passive venting or oxidation) system is necessary to protect human health and the environment and to assist with gas collection design.

The Tidal Area at NWS SBD Concord is located on a site originally occupied in part by a copper smelting operation from 1901 to 1908 and later by the Pacific Coast Shipbuilding Company. The copper smelting and ship building operations occurred in the area north of what is now the Tidal Area Landfill (Landfill) Site 1. The distance from the landfill to the former smelting and shipbuilding operations is estimated to be more than 1,000 feet. Otter Sluice was constructed to drain surface water and groundwater from the Tidal

Area to Suisun Bay. The sluice is believed to have passed through the current location of the Landfill. During construction of NWS SBD Concord in 1942, the portion of this sluice that passed through the present location of the Landfill was backfilled and the sluice was rerouted around the Landfill.

The Landfill is located along the western side of Johnson Road, just north of Froid Road. The Landfill covers 13 acres and contains an estimated 125,000 to 135,000 cubic yards of waste and cover soil. The landfill received household refuse from the base and surrounding communities, as well as facility waste and construction debris. The landfill reportedly received solvents, acids, paint cans, creosote-treated timbers, asphalt, concrete, asbestos, and ordnance materials, including inert munitions.

According to the initial assessment study, tritonal from a 750-pound, general-purpose bomb was reportedly buried in the landfill. The initial assessment study did not cite the source of information. Subsequent inquiries have not determined the information source. Navy sources consider the tritonal disposal to be a highly unlikely event because the protocol for disposal of explosives does not include landfill disposal. Other safe and appropriate disposal methods for this type of material were in practice at the time. If tritonal was disposed of in violation of Navy rules, it would be subject to degradation with exposure to the elements. Degradation of tritonal by weathering tends to increase the stability of the material.

The landfill consists predominantly of ruderal non-native grassland habitat. The surface of the landfill is discontinuous soil cover that is mixed with waste throughout the depth of the landfill. Currently, rubble, metal scraps, and wood debris are visible through the soil layer. Animal burrows and differential subsidence have resulted in a highly uneven surface interrupted by deep potholes.

A site inspection of the Landfill was subsequently conducted from April 1988 to January 1991. Groundwater, surface water, soil, and sediment samples were collected within the Tidal Area Landfill. Results revealed the presence of volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polynuclear aromatic hydrocarbons (PAH), the pesticide dieldrin, the polychlorinated biphenyl (PCB) Aroclor-1260, metals, and the nitroaromatic explosive compound nitrobenzene. However, since this integrated surface sampling survey (LFG characterization) is not an intrusive investigation, these chemicals should not pose a health threat to field personnel.

Integrated surface sampling will be conducted to characterize LFG to support landfill closure design. This one-time sampling event will provide data for the design of the LFG vents on the final cover of the landfill. Sample locations will be determined in the field to evaluate potential LFG emissions from the surface of the landfill. Locations for samples will be selected based on a modified integrated surface sampling protocol. Health and Safety Code 41805.5 requires testing of the air immediately above the disposal site surface using an integrated surface sampling technique that includes a technician walking a prescribed course over a 50,000 square-foot grid and collecting LFG samples. However, due to the concern for potential of cave-ins on the surface of the landfill and the potential to encounter MEC, a modified integrated surface sampling protocol is proposed.

Once background concentrations are determined following California Air Resources Board (CARB) procedures, the landfill surface will be screened to evaluate potential LFG emissions from the surface of the landfill. Site personnel conducting the monitoring will be required to walk slowly along the uneven surface of the landfill to monitor existing surface cracks. New openings will not be created. If an unstable area of the landfill is encountered or MEC is observed, site personnel will safely exit the area from the direction in which they entered. Vehicles will not be allowed on the landfill.

A LFG analyzer (such as a Lantec® Gem 500 model or equivalent) will be used to measure methane, oxygen, and carbon dioxide. A portable hydrogen sulfide analyzer (Jerome 631-X or equivalent) will also be used for measuring hydrogen sulfide levels. If an oxygen deficient area is measured (less than 19.5 percent oxygen), then site personnel will immediately evacuate the area in the direction from which they entered, and work will cease in that area until the appropriate personal protective equipment is determined. An oxygen-deficient atmosphere could potentially occur in a low-lying area with little or no air movement. Monitoring points with a methane concentration greater than 50 parts per million (ppm) will be recorded on a topographic map. Areas not monitored due to safety concerns will also be recorded on a topographic map.

A photoionization detector (PID) will be used to monitor the worker breathing zone when any surface screening area exceeds 20 ppm. If PID readings in the breathing zone exceed 2 ppm, then an air-purifying respirator will be required. An air sample will be collected from the location exhibiting the highest methane concentration. Site personnel will monitor the breathing zone with the PID while collecting the surface air sample since they may be closer to the ground, and higher concentrations of LFG, while collecting the sample. Air samples collected will be analyzed for methane, carbon dioxide, hydrogen sulfide, and trace gases such as tetrachloroethene, trichloroethylene, methylene chloride, benzene, vinyl chloride, ethylene dichloride, chloroform, carbon tetrachloride, and ethylene dibromide.

Note: A site map, definitions, and additional information are provided on the last three pages of this form.

Waste Management Practices:

The landfill received household refuse from the base and surrounding communities, as well as facility waste and construction debris. The landfill reportedly received solvents, acids, paint cans, creosote-treated timbers, asphalt, concrete, asbestos, and ordnance materials, including inert munitions. Soil samples results for samples collected at the perimeter of the Landfill revealed the presence of VOCs, SVOCs, PAHs, dieldrin, the PCB Aroclor-1260, metals, and the nitroaromatic explosive compound nitrobenzene.

Waste Types: ☐ Liquid ☒ Solid ☐ Sludge ☒ Gas

Waste / Chemical Characteristics:

	☐ Corrosive	☐ Oxidizer	☒ Flammable
☒ Toxic	☒ Explosive	☒ Volatile	☐ Radioactive
☐ Reactive	☐ Inert		☐ Other *(specify)* ____________________

Chemical / Health Hazards of Concern:

☒ Explosion or fire hazard – monitor with combustible gas meter	☐ Inorganic chemicals
☒ Oxygen deficiency – monitor with oxygen meter	☒ Organic chemicals
☒ Landfill gases – monitor with methane and hydrogen sulfide meter	☐ Petroleum Hydrocarbons
☐ Surface tanks	☐ Underground storage tanks
☐ Potential inhalation or skin absorption hazard that is immediately dangerous to life and health (IDLH) – **must use long form**	☐ Other *(specify)* ____

Explosion or Fire Potential: ☐ High ☐ Medium ☐ Low ☒ Unknown

Radiological Hazards of Concern:

- ☐ Ionizing radiation (Radioactive materials, X-ray) **(must use long form)**
- ☐ Non-ionizing radiation (ultraviolet, lasers)

Safety Hazards of Concern: (Based on anticipated clean-up operations)

- ☐ Heavy Equipment
- ☐ Pinch points
- ☐ Energized and rotating equipment (drill rig)
- ☐ Steam cleaning equipment
- ☐ Excavations
- ☐ Welding or torch cutting (Hot work)
- ☐ Sharp Objects
- ☐ Hazardous energy sources (electrical, hydraulic)
- ☐ Buried utilities
- ☐ Overhead utilities
- ☐ Suspended loads
- ☐ Buried drums
- ☐ Work over or near water
- ☐ Work from elevated platforms
- ☐ Manual Lifting
- ☐ Other *(specify)* ______________________

Physical Hazards of Concern:

- ☒ Heat stress
- ☐ Cold stress
- ☒ Slips, trips, falls
- ☐ Illumination
- ☐ Vibration
- ☐ Noise
- ☒ Solar (sunburn)
- ☒ Unstable or steep terrain
- ☒ Other *(specify)* Surface cave-ins and MEC; Evacuate immediate area

Biological Hazards of Concern:

- ☐ Poisonous plants (poison ivy, poison oak)
- ☐ Spiders (black widow or brown recluse spiders)
- ☐ Medical waste
- ☐ Snakes (rattlesnakes)
- ☐ Stinging insects (bees, wasps)
- ☐ Animals (feral dogs, mountain lions, etc.)
- ☐ Blood or other body fluids

Unexploded Ordnance:

- ☐ Unexploded Ordnance (UXO) **(must use long form)**
- ☐ Chemical Warfare Materials (CWM) **(must use long form)**
- ☐ Explosive ordnance waste (OEW) **(must use long form)**

Chemical Products Tetra Tech EMI Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- ☐ Alconox® or Liquinox®
- ☐ Hydrochloric acid (HCl)
- ☐ Nitric Acid (HNO_3)
- ☐ Sodium hydroxide (NaOH)
- ☐ Sulfuric Acid (H_2SO_4)
- ☐ Other *(specify)* ______________________________
- ☐ Other *(specify)* ______________________________
- ☐ Other *(specify)* ______________________________
- ☐ Other *(specify)* ______________________________
- ☐ Other *(specify)* ______________________________
- ☐ Other *(specify)* ______________________________

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	PEL/TLV (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Symptoms and Effects of Acute Exposure	Photo-ionization Potential (eV)
benzene	U	PEL = 1 ppm TLV = 0.5 ppm	500 ppm CARC	Acute: eye, mucous membrane, throat, and skin irritation; CNS depression (headache, nausea, dizziness, and fatigue) Chronic: known human carcinogen; causes leukemia; damage to bone marrow	9.24
carbon dioxide	U	PEL = 5,000 ppm TLV = 5,000 ppm	40,000 ppm	Acute: asphyxiant, headache, dizziness, restlessness Chronic: none	NA
carbon tetrachloride	U	PEL = 2 ppm (skin) TLV = 5 ppm (skin)	200 ppm CARC	Acute: irritation to eyes and skin; CNS depressant (headache, nausea, dizziness, and fatigue) Chronic: suspect human carcinogen, liver and kidney damage	11.47
chloroform	U	PEL = 2 ppm TLV = 10 ppm	500 ppm CARC	Acute: irritation to eyes, skin, CNS depressant, (headache, nausea, dizziness, and fatigue); cardiac arrest Chronic: suspect human carcinogen, liver and kidney damage	11.42
ethylene dibromide	U	PEL = 0.13 ppm (skin) TLV = not established	100 ppm CARC	Acute: severe mucous membranes, eye, and skin irritant; CNS depressant (headache, nausea, dizziness, and fatigue) Chronic: suspect carcinogen; skin sensitizer; liver and kidney damage	9.45

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	PEL/TLV (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Symptoms and Effects of Acute Exposure	Photo-ionization Potential (eV)
ethylene dichloride	U	PEL = 1 ppm TLV = 10 ppm	50 ppm CARC	Acute: irritation to eyes, skin, CNS depressant (headache, nausea, dizziness, and fatigue); causes damage to cornea Chronic: suspect human carcinogen, liver and kidney damage	11.05
hydrogen sulfide	U	PEL = 10 ppm STEL = 15 ppm TLV = 10 ppm	100 ppm	Acute: irritant of eyes and respiratory tract; nervousness, headache, fatigue; causes respiratory paralysis at higher concentrations and asphyxiation Chronic: none	10.46
methane	U	None established	NA	Acute: displaces oxygen and causes asphyxiation	NA
methylene chloride	U	PEL = 25 ppm TLV = 50 ppm	2,300 ppm CARC	Acute: CNS depression (headache, nausea, dizziness, and fatigue), and eye, skin, and respiratory tract irritant Chronic: suspect human carcinogen	11.32
tetrachloroethene (perchloroethylene)	U	PEL = 25 ppm TLV = 25 ppm	150 ppm CARC	Acute: CNS depression (headache, nausea, dizziness, and fatigue); eye and mucous membrane irritation Chronic: suspect human carcinogen	9.32
trichloroethylene	U	PEL = 25 ppm TLV = 50 ppm	1,000 ppm CARC	Acute: CNS depression (headache, nausea, dizziness, and fatigue); skin contact causes defatting of the skin; dermatitis; heart sensitization Chronic: suspect human carcinogen; damage to liver and animal carcinogen	9.45

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	PEL/TLV (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Symptoms and Effects of Acute Exposure	Photo-ionization Potential (eV)
vinyl chloride	U	PEL = 1 ppm TLV = 1 ppm	CARC NE	Acute: weakness, abdominal pain, affects gastrointestinal system, Chronic: known human carcinogen; causes liver cancer	9.99

Notes: The chemicals listed are constituents of typical landfill gas (*The Landfill Testing Program: Data Analysis and Evaluation Guidelines*, CARB, September, 1990). The trace constituents in landfill gas (excluding methane, carbon dioxide, and hydrogen sulfide) cumulatively account for less than 1 percent by volume.

CARC = Carcinogenic CNS = Central nervous system eV = Electron volt	IDLH = Immediately dangerous to life or health mg/m^3 = Milligram per cubic meter	NA = Not applicable NE = Not established PEL = Permissible exposure limit	ppm = Part per million STEL = Short term exposure limit	TLV = Threshold limit value U = Unknown

Field Activities Covered Under This Plan:

Task Description [1]	Type	Level of Protection: Primary		Level of Protection: Contingency		Date of Activities
		C	D	C	D	
1 Conduct integrated surface sampling	☐ Intrusive ☒ Nonintrusive	☐ C	☒ D	☒ C	☐ D	2004
2 Not applicable	☐ Intrusive ☐ Nonintrusive	☐ C	☐ D	☐ C	☐ D	Not applicable

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code	Task	Responsibilities
John Bosche, SF	1	Program Manager or Designated Leader: Directs project investigation activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary.
To be determined	1	SSC: Ensures that appropriate personal protective equipment (PPE) is available, enforces proper utilization of PPE by on-site personnel, suspends investigative work if he or she believes that site personnel are or may be exposed to an immediate health hazard, implements the health and safety plan, and reports any observed deviations from anticipated conditions described in the health and safety plan to the health and safety representative.
To be determined	1	Field Personnel: Complete tasks as directed by the program manager, field team leader, and SSC and follow all procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual.
To be determined	1	Alternate SSC: See above

[1] ***Make copies of this page if more than 2 tasks are anticipated for the project.***

Protective Equipment: (Indicate type or material as necessary for each task; attach additional sheets as necessary)

Task: ☒ 1 ☐ 2 Level: ☐ C ☒ D ☒ Primary ☐ Contingency	Task: ☒ 1 ☐ 2 Level: ☒ C ☐ D ☐ Primary ☒ Contingency
RESPIRATORY ☒ Not needed ☐ APR: ______ ☐ Cartridge: ______ ☐ Escape mask: ______ ☐ Other: ______	RESPIRATORY ☐ Not needed ☒ APR: full-face ☐ Cartridge: organic vapor ☐ Escape mask: ______ ☐ Other: ______
PROTECTIVE CLOTHING ☐ Not needed ☐ Tyvek® coveralls: ______ ☐ Saranex® coveralls: ______ ☐ Coveralls: ______ ☐ Other: ______	PROTECTIVE CLOTHING ☐ Not needed ☐ Tyvek® coveralls: ______ ☐ Saranex® coveralls: ______ ☐ Coveralls: ______ ☐ Other: ______
HEAD AND EYE ☐ Not needed ☒ Safety glasses: ______ ☐ Face shield: ______ ☐ Goggles: ______ ☒ Hard hat: ______ ☐ Other: ______	HEAD AND EYE ☐ Not needed ☒ Safety glasses: ______ ☐ Face shield: ______ ☐ Goggles: ______ ☒ Hard hat: ______ ☐ Other: ______
GLOVES ☐ Not needed ☐ Undergloves: ______ ☒ Gloves: Nitrile ☐ Overgloves: ______	GLOVES ☐ Not needed ☐ Undergloves: ______ ☒ Gloves: Nitrile ☐ Overgloves: ______
FIRST AID EQUIPMENT ☐ Not needed ☒ Standard First Aid kit ☐ Portable eyewash	FIRST AID EQUIPMENT ☐ Not needed ☒ Standard First Aid kit ☐ Portable eyewash
BOOTS ☐ Not needed ☒ Work boots: Steel-Toe/Steel ☐ Overboots: ______	BOOTS ☐ Not needed ☒ Work boots: Steel-Toe/Steel ☐ Overboots: ______
OTHER ☐ (specify): ______	OTHER ☐ (specify): ______

Note: APR = Air purifying respirator

Monitoring Equipment: (Specify instruments needed for each task; attach additional sheets as necessary)				
Instrument	Task	Instrument Reading	Action Guideline	Comments
Combustible gas indicator model: Lantec® Gem 500 or equivalent	☒ 1	0 to 10% LEL	No explosion hazard	☐ Not needed
	☐ 2	10 to 25% LEL	Potential explosion hazard; notify SSC	
		> 25% LEL	Explosion hazard; interrupt task; evacuate immediate area, notify SSC	
O_2 meter model: Lantec® Gem 500 or equivalent	☒ 1	> 23.5% O_2	Potential fire hazard; evacuate immediate area	☐ Not needed
	☐ 2	23.5 to 19.5% O_2	Oxygen level normal	
		< 19.5% O_2	Oxygen deficiency; interrupt task; evacuate immediate area; notify SSC	
Photoionization detector model: ☐ 11.7 eV ☒ 10.6 eV ☐ 9.8 eV ☐ _____eV	☒ 1	0 to 2 ppm above background	Level D	☐ Not needed
	☐ 2	>2 to 100 ppm above background	Level C	
		>100 ppm above background	Evacuate immediate area; notify SSC	
Flame ionization detector model:	☐ 1	>0 to 5 ppm above background	Level D	☒ Not needed
	☐ 2	>5 to 50 ppm above background	Level C	
		>50 ppm above background	Evacuate site; notify SSC	
Respirable dust monitor model:	☐ 1 ☐ 2	Specify:	Specify:	☒ Not needed
Other: (specify): hydrogen sulfide analyzer (Jerome 631-X or equivalent	☒ 1 ☐ 2	0 to 5 ppm > 5 ppm	Level D Evacuate immediate area; notify SSC	☒ Not needed

Notes: eV = Electron volt
LEL = Lower explosive limit
ppm = Part per million
SSC = Site safety coordinator
O_2 = Oxygen

Site Map (if available):

Additional Comments:	**Emergency Contacts:**	**Telephone**
Tetra Tech EMI site workers will contain and absorb any chemicals used or transferred on site.	U.S. Coast Guard National Response Center	800/424-8802
	InfoTrac	800/535-5053
	Fire department	911
	Police department	911
	Tetra Tech EMI Personnel:	
	Corporate Human Resource Manager: Norman Endlich	703/390-0626
	Corporate Health & Safety Manager: Judith Wagner	847/818-7192
	Office Health & Safety Coordinator: Will Warren	415/222-8293
	Program Manager: Joanna Canepa	415/222-8362
	Site Safety Coordinator: To be determined	

Personnel Decontamination and Disposal Method:

Personnel will follow the U.S. Environmental Protection Agency's "Standard Operating Safety Guides" for decontamination procedures for Level D personal protection (with modified Level C contingency). The following decontamination stations should be set up in each decontamination zone:

- Segregated equipment drop
- Boot and glove wash and rinse
- Disposable glove, bootie, and coverall removal and segregation station
- Safety glasses and hard hat removal station
- Hand and face wash and rinse

If site conditions require upgrade to Level C, a station must be set up for respirator removal, respirator decontamination, and cartridge disposal.

All disposable equipment, clothing, and wash water will be double-bagged or containerized in an acceptable manner and disposed of in accordance with local regulations.

Medical Emergency:

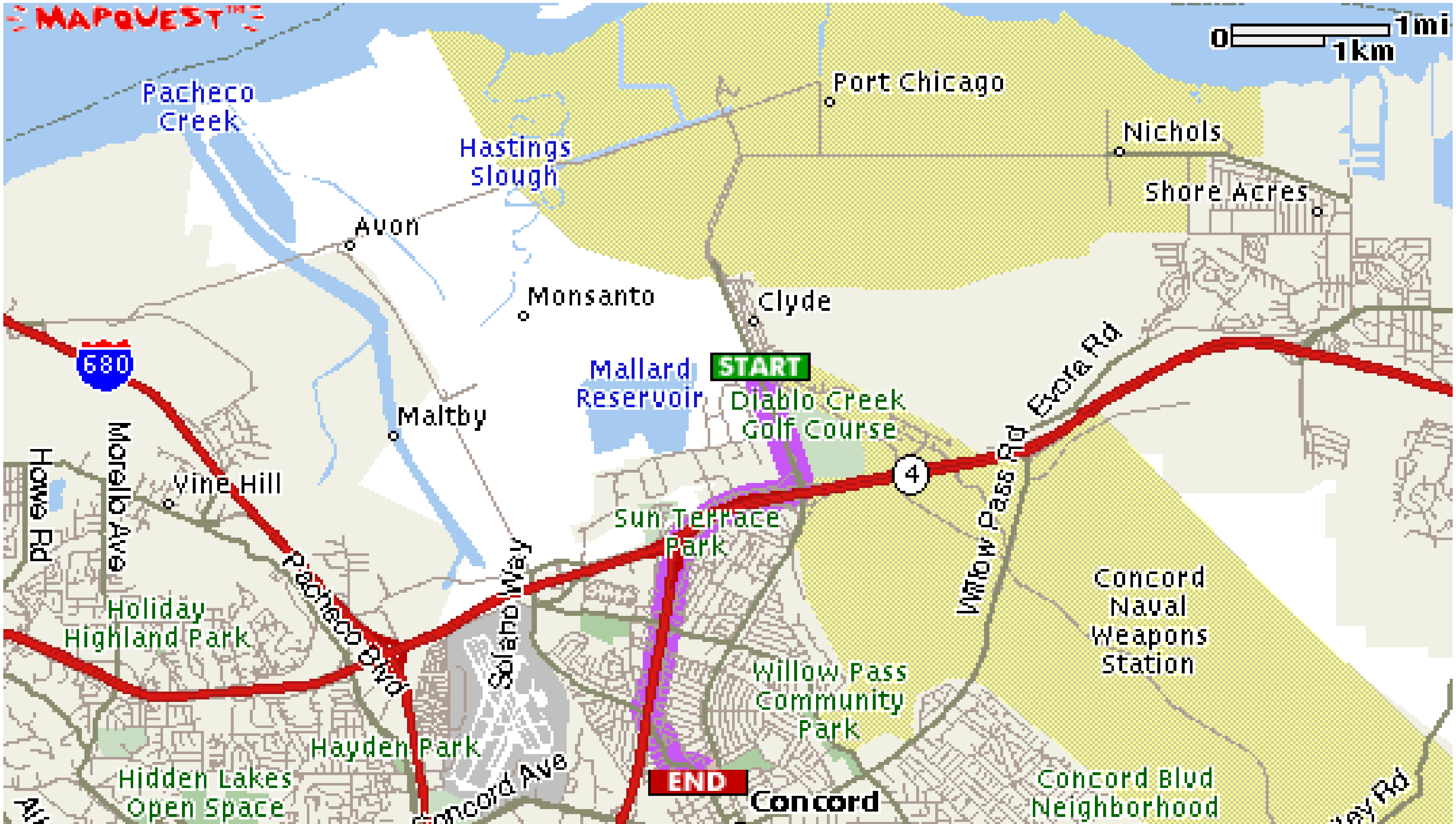
Hospital Name:	Mount Diablo Medical Hospital
Hospital Address:	2540 East St, Concord, CA
Hospital Telephone:	Emergency - 911 General – (925) 682-8200
Ambulance Telephone:	911

Route to Hospital: (see next page for route map)

1.	Exit NWSSBD Concord and go South on PORT CHICAGO HWY	
2.	Take the CA-4 W ramp toward RICHMOND.	
3.	Merge onto CA-242 S toward OAKLAND/CONCORD.	1.6 miles
4.	Take the SOLANO WAY exit toward GRANT ST.	0.1 miles
5.	Take the ramp toward GRANT ST.	<0.1 miles
6.	Turn LEFT onto SOLANO WAY.	<0.1 miles
7.	SOLANO WAY becomes GRANT ST.	0.5 miles
8.	Turn SHARP LEFT onto EAST ST.	<0.1 miles
9.	End at 2540 EAST ST CONCORD CA	

Note: This page must be posted on site.

Hospital Route Map (if available):



Note: This page must be posted on site.

APPROVAL AND SIGN-OFF FORM

Project No. G1058.1.1.01.032.02

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator as well as procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

APPROVALS: (Two Signatures Required)

Site Safety Coordinator	Date
Program Manager or Designee	Date

DEFINITIONS

Intrusive - Work involving excavation to any depth, drilling, opening of monitoring wells, most sampling, and Geoprobe® work

Nonintrusive - Generally refers to site walk-throughs or field reconnaissance

Levels of Protection

Level D - Hard hat, safety boots, and glasses, may include protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Level C - Hard hat, safety boots, glasses, and air purifying respirators with appropriate cartridges, **PLUS** protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Emergency Contacts

InfoTrac - For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Health and Safety Plan Short Form

- Used for field projects of limited duration and with relatively limited activities; may be filled in with handwritten text
- Limitations:
  - No Level B or A work
  - Limited number of tasks
  - No confined space entry
  - No unexploded ordnance work or radiation hazard

APPENDIX C
STANDARD OPERATING PROCEDURES

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 2

Last Reviewed: December 1999

K Riesing

Quality Assurance Approved

February 2, 1993

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles

- Alconox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

2. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

3. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

5. Remove disposable gloves and place them in plastic bag for disposal.

6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on-site before drilling operations begin, between borings, and at completion of the project.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting.

The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket using a stiff, long bristle brush and Liquinox or Alconox solution.
2. Steam clean the sampling equipment over the rinsate tub and allow to air dry.
3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
4. Containerize all water and rinsate.

5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SOIL GAS SAMPLING METHODS

SOP NO. 074

REVISION NO. 1

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Quality Assurance Approved

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Date

1.0 BACKGROUND

Soil gas samples can be collected using several methods. This standard operating procedure (SOP) presents sample collection procedures for collecting soil gas samples in Tedlar® bags, glass sampling bulbs, and stainless-steel canisters. Tedlar® bags and glass sampling bulbs are best suited for on-site or near-site chemical analysis, whereas steel canisters are best suited for shipping samples to a full service laboratory.

1.1 PURPOSE

The purpose of this SOP is to provide guidance for the use of Tedlar® bags, glass sampling bulbs, and stainless-steel canisters for soil gas sample collection. Soil gas samples collected by these methods may be analyzed for volatile organic compounds such as trichloroethene, benzene, and toluene and for inorganic parameters such as nitrogen, oxygen, and carbon dioxide.

1.2 SCOPE

This SOP applies to all personnel collecting soil gas samples in Tedlar® bags, glass sampling bulbs, or stainless-steel canisters. The site-specific work plan and sampling plan should be followed during soil gas sampling activities.

1.3 DEFINITIONS

Soil Gas - The gases or atmosphere filling the void spaces in soils and unconsolidated sediments. These gases may all be of natural origin, but manmade contaminants or by-products may be present in detectable quantities.

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods*. Second Edition. EPA-600/4-84-076. December.

When using steel canisters to collect soil gas, the following items are needed:

- A supply of clean, evacuated stainless-steel canisters (SUMMA canisters) with a pressure gauge to verify internal pressure
- A vacuum pump (SKC universal flow pump or equivalent) to allow purging of the sample point prior to collection of soil gas samples
- Tygon tubing or equivalent of appropriate size for connecting the sampling port to pump (during gas point purging) and the sampling port to stainless steel canister (during sample collection)
- Y-branched tubing (plastic, Teflon®-lined if available) for duplicate collection

2.0 PROCEDURES

This section describes selection of soil gas sampling locations and general preparation of the sampling system to be used. This section also provides detailed procedures for collecting samples using Tedlar® bags, glass bulbs, and stainless-steel canisters. Finally, this section discusses additional considerations that affect soil gas sampling, including duplicate and equipment blank sample collection, decontamination, and sample transfer, and summarizes the advantages and disadvantages of each sampling method.

2.1 SAMPLING LOCATION SELECTION

Sampling locations should be selected and prepared for sampling as described in a site-specific quality assurance project plan and field sampling plan. Soil gas samples may be collected from depths as shallow as 3 feet or as great as 50 feet, depending on the objectives of the project, the site soil conditions, and the specific equipment used to penetrate to depth. The horizontal spacing of soil gas sampling points (grid size) may be only a few feet or more than 500 feet. Again, this is a function of project-specific objectives and site conditions.

2.2 SAMPLING SYSTEM PREPARATION

The sample probe assemblies may consist of three types: (1) a hand-driven soil gas probe 4 feet in length, (2) a drill rig-driven soil gas probe 2 feet in length, (3) a hydraulic-driven soil gas probe 3 feet in length. The probes may be assembled in series to reach the desired sampling depth. The probes will be driven to or emplaced at the desired sample collection depth, and then fitted with the Tygon sampling line.

Once fitted with the sampling line, the ambient air within the sampling system is purged. Usually, three system volumes are purged prior to sample collection. If the sampling system purge volume cannot be measured, then a standard purge time of 3 to 5 minutes should be used.

After the system is purged of ambient air but before the pump is turned off, approximately 2 inches of the sampling line closest to the entrance port of the pump should be folded over itself and the tubing should be clamped to keep ambient air from reentering the system. This is not necessary when sampling with glass bulbs because the bulbs are already connected to the sampling line. After the system is purged and sealed to ambient air, the pump should be turned off. Sample collection can now proceed using a Tedlar® bag, a glass bulb, or a stainless-steel canister.

2.3 SAMPLE COLLECTION USING TEDLAR® BAGS

Soil gas can be collected for chemical analysis in a 500-cc Tedlar® gas sampling bag. This can be accomplished by using an SKC pump to induce a vacuum on the exterior of the bag. This will cause the Tedlar® bag to be inflated with soil gas. The following procedure should be used:

1. Connect the free end of the Tygon tubing (previously inserted through the top of the vacuum chamber) to the Tedlar® gas sampling bag. Open the valve on the gas sampling bag and place the tubing into the body of the vacuum chamber.

2. Place the top on the vacuum chamber.

3. Connect the free end of the evacuation tube to the SKC pump.

4. Turn on the pump. This should create a vacuum in the chamber, and the Tedlar® bag should fill at a rate of approximately 2 liters per minute. The rate at which the Tedlar® gas sampling bag fills will depend on the porosity and permeability of the soil.

5. The minimum amount of soil gas needed for analysis is approximately 0.25 liter.

6. If less than 0.25 liter is collected after 4 minutes of sampling, raise the soil gas probe 0.5 foot (if possible). Continue to evacuate the vacuum chamber for another minute. If the minimum required soil gas is not collected, repeat the procedure again. If the minimum required volume of soil gas is still not collected, abandon the collection process. All steps conducted are to be accurately recorded in the field logbook.

7. Remove the top of the vacuum chamber after the soil gas sample is collected in the Tedlar® bag.

8. Close the valve on the Tedlar® gas sampling bag, clamp the Tygon tubing, and remove the Tedlar® gas sampling bag.

9. Turn off the pump.

10. Label the Tedlar® bag and its corresponding field datasheet (Figure 1) with the sample number.

11. Fill out the rest of the field datasheet. An alternative documentation procedure is to enter the requisite information in the field logbook.

2.4 SAMPLE COLLECTION USING GLASS BULBS

Soil gas also can be collected for chemical analysis in a glass bulb. When this sampling method is used, the glass bulb must be connected to the sampling system and purged of ambient air along with the sampling line before the sample is collected. The system is purged and the sample is collected using the following procedure:

1. Connect one end of the glass bulb to the sample line and the other end of the glass bulb to the vacuum pump using Tygon tubing, and then open both stopcocks on the bulb.

2. Turn on the vacuum pump and purge the sampling system as discussed in Section 2.2.

3. Turn off the vacuum pump.

4. Observe the inline pressure gauge to determine when the vacuum in the bulb has been filled with soil gas. This may require several minutes, particularly in soils with low porosity and permeability. If the vacuum in the bulb has not dropped after 4 minutes of sampling, raise the soil gas probe in 0.5-foot increments in an attempt to find a more permeable zone. If the soil gas probe is moved, guard against leakage of ambient air into the system and repurge if necessary.

5. Once the vacuum in the gas sampling bulb has been filled, close off the upstream stopcock on the bulb, then the downstream stopcock and disconnect the bulb from the sample line.

6. Label the glass bulb and its corresponding field datasheet with the sample number.

7. Fill out the rest of the field datasheet. An alternative documentation procedure is to enter the requisite information in the field logbook.

2.5 SAMPLE COLLECTION USING STAINLESS-STEEL CANISTERS

Soil gas also can be collected for chemical analysis in a stainless-steel, evacuated canister. Usually, these expensive canisters are used to collect duplicate samples for off-site analysis from locations that are being sampled for field screening analysis using Tedlar® bags or glass bulbs.

When this method is used, the canister is connected directly to the purged Tygon sampling tube. To prevent ambient air from entering the canister during sample collection, all connections must be airtight. To collect soil gas samples using this method, the following procedure is used:

1. Measure the canister pressure reading, ambient air temperature, and ambient air pressure, and record the readings in the field logbook prior to sample collection.

2. Open the canister pressure valve, which will allow the evacuated stainless-steel canister to draw in soil gas until the canister reaches ambient pressure. When the sampling valve on the canister shows that ambient pressure has been reached, close the sampling valve and remove the canister from the sampling line.

3. Measure and record the post-sampling pressure reading on the canister pressure valve.

4. Label the canister and its corresponding field datasheet with the sample number.

5. Fill out the rest of the field datasheet. An alternative documentation procedure is to enter the requisite information in the field logbook.

2.6 DUPLICATE AND EQUIPMENT BLANK COLLECTION

Duplicate soil gas samples will be collected at each site as required in the site-specific sampling plan and quality assurance project plan. Generally, 1 duplicate sample will be collected for every 10 samples collected. Each duplicate is collected in conjunction with a corresponding environmental sample.

To collect duplicate samples, a Y-branched sampling hose will be connected to the vacuum chamber or pump. Two Tedlar® bags, glass bulbs, or stainless-steel canisters will be attached, one to each end of the Y-branched hose. Sample collection will proceed as described above. After collection, one sample will be labeled as the environmental sample and one as the duplicate.

Equipment blanks also will be collected at each site as required in the site-specific sampling plan and quality assurance project plan. Generally, 1 blank will be collected for every 10 samples collected. Blanks will be collected by running ambient air through the sampling system immediately after it has been decontaminated, and by collecting the ambient air in a Tedlar® bag, glass bulb, or stainless-steel canister using the same procedures used to collect environmental samples. Blank sample collection is conducted upwind of any observed interference, and the location of the sampling should be recorded in the field logbook. Equipment blanks are collected to ensure that field equipment decontamination procedures are adequate.

2.7 DECONTAMINATION

Sampling probes should be decontaminated before the first sample is collected and between sampling points. Probes that are grossly contaminated should be decontaminated using a high pressure steam cleaner. Probes that are not grossly contaminated can be decontaminated by brushing off loose soil particles, then heating the probes until they are warm to the touch to drive off any volatile contaminants. Heating times of 7 to 10 minutes are generally sufficient for this purpose. This brushing and heating method greatly reduces the generation of decontamination fluids.

Glass sampling bulbs also must be decontaminated between each use. This may be accomplished by purging heated air through the bulbs using a hand-held hair drier and the vacuum pump. Highly contaminated bulbs may require decontamination using either a methanol or soapy water wash and a deionized water rinse.

If Y-branched tubing or any other sampling equipment is to be reused, it must also be decontaminated between sampling locations.

2.8 SAMPLE TRANSFER

After collection, each sample container will be transported to the designated laboratory for analysis. In many cases, samples will be analyzed on site in a mobile laboratory.

2.9 ADVANTAGES AND DISADVANTAGES OF EACH SAMPLING METHOD

Tedlar® bags are relatively inexpensive to use but can only be used once and then must be disposed of. If the soil formation being sampled has a low porosity and permeability, such as clay or silty clay, it may not be possible to inflate the Tedlar® bag with soil gas.

Glass bulbs are more expensive than Tedlar® bags but they can be reused indefinitely, as long as they are not broken. However, bulbs must be decontaminated between each use, and periodic equipment blanks must be analyzed to verify that the decontamination procedures used are effective.

Stainless-steel canisters are very expensive and, therefore, are not cost-effective when conducting on-site analysis. The advantage of this type of sampler is that confirmation samples may be collected and shipped off-site for analysis with excellent assurance of sample integrity.

3.0 CAUTIONS

Both Tedlar® bags and glass bulbs are transparent to light, and many volatile compounds are subject to degradation in sunlight. Because of this, samples should be stored in a dark place, such as a cooler, and analyzed as quickly as possible. In general, samples collected in Tedlar® bags or glass bulbs should be analyzed within 24 hours after collection, at a maximum. This will ensure sample integrity and minimize contaminant loss by degradation processes or absorption onto surfaces.

The concentration of volatile organic contaminants in the vapor phase in soil gas is a function of many complex and dynamic variables. Because of this, soil gas results do not usually show a direct correlation to groundwater contamination. However, soil gas may show a good relation to groundwater conditions and is therefore a very powerful tool for quickly and inexpensively locating sources of volatile organic contamination in groundwater.

While sampling, each sampling location should be screened with a flame ionization detector (FID) or photoionization detector (PID) following sample collection. The result of the FID or PID screening should be recorded on the sample container and field sheet so that the chemist analyzing the sample can determine whether sample dilutions or smaller sample volumes are required for analysis.

FIGURE 1

FIELD DATASHEET FOR SOIL GAS SAMPLING METHODS

Date: ________________________________ Site/Facility Name: ______________________

Time: ________________________________ Project No.: ____________________________

Sample Container: _______ Tedlar® Bag: ______ Glass Bulb: _______ SUMMA® canister: _______

Sampling location and depth: ____

Description of location: ____

____

Sample location purged: Yes ______________ FID or PID (circle one) Reading: ________________

Sample relinquished by: ________________________ Date/Time: ________________

Sample received by: ___________________________ Date/Time: ________________

Attach field copy of sample label or write in sample number:

Notes:

APPENDIX D
FIELD FORMS

FIELD DATASHEET FOR SOIL GAS SAMPLING METHODS

Date: ______________________________ Site/Facility Name: ____________________

Time: ______________________________ Project No.: _________________________

Sample Container: ______ Tedlar® Bag: _____ Glass Bulb: ______ SUMMA® canister: ______

Sampling location and depth: ____

Description of location: ____

____

Sample location purged: Yes _____________ FID or PID (circle one) Reading: _______________

Sample relinquished by: ______________________ Date/Time: _______________

Sample received by: _________________________ Date/Time: _______________

Attach field copy of sample label or write in sample number:

Notes:

Weather:

Name:
Date:

Monitoring Log

Sampling Location						GEM500				PID		Jerome 631-X	
Location ID	Description (for example, LFG monitoring probe/ surface sample)	Water Level (feet below casing)	Time	Temp (°C/°F)	Barometric Pressure (in Hg)	Methane (GEM %)	CO2 (GEM %)	O2 (GEM %)	LEL (%)	Non-Methane VOCs (ppm)	Bckgrd. NMOCs (ppm)	Hydrogen Sulfide (ppm)	**Notes:** ie. probe damage, instrument issues, etc.

Notes:
LFG = Landfill gas
PID = Photoionization detector

APPENDIX E
PROJECT-REQUIRED REPORTING LIMITS

TABLE E-1: ANALYTICAL REPORTING AND REGULATORY LIMITS FOR LANDFILL GAS SAMPLES

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Volatile Organic Compounds	PRRL (ppbv)[a]	OSHA PEL (ppmv)[b]	PRRL Meets PEL (Yes/No)?
Benzene	0.5	10	Yes
Carbon Tetrachloride	0.5	10	Yes
Ethylene Dibromide	0.5	20	Yes
Ethylene Dichloride	0.5	50	Yes
Tetrachloroethene	0.5	100	Yes
Trichloroethene	0.5	100	Yes
Methylene Chloride	0.5	12.5	Yes
Vinyl Chloride	0.5	0.5	Yes
Methyl Chloroform	0.5	350	Yes
Chloroform	0.5	50	Yes

Notes:

a The listed PRRL reflects the standard sensitivity of EPA Method TO-15 (Air Toxics Limited Methods Manual, Revision 12, March 2004). The listed PRRL will be used as the project screening criteria unless reasonable grounds are established for pursuing nonroutine methods.

b 8-hour time weighted average

EPA U.S. Environmental Protection Agency
OSHA Occupational Safety and Health Administration
PEL Permissible exposure limit
ppbv Parts per billion by volume in air
ppmv Parts per million by volume in air
PRRL Project-required reporting limit
TO Toxic organic

TABLE E-2: STATEWIDE LANDFILL GAS TESTING RESULTS

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Chemical	Statewide Landfill Gas Testing – Nonhazardous Refuse Sites [a]	
	Concentration Range [b] (ppmv)	Percent of 271 Sites Where Detected
Benzene	500 – 29,000	51
Carbon Tetrachloride	5 – 2,100	8
Ethylene Dibromide	1 – 2,000	7
Ethylene Dichloride	20 – 34,000	18
Tetrachloroethene	10 – 62,000	72
Trichloroethene	10 – 20,000	68
Methylene Chloride	60 – 260,000	56
Vinyl Chloride	500 – 120,000	47
Methyl Chloroform	10 – 21,000	49
Chloroform	2 – 171,000	27

Notes:

a California Air Resources Board, 1990, Landfill Testing Program: Data Analysis and Evaluation Guidelines, Sacramento, California.

b Concentration range represents the approximate lowest value (the detection limit) to the highest reported value.

ppmv Parts per million by volume in air

TABLE E-3: OSHA PERMISSIBLE EXPOSURE LIMITS

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Volatile Organic Compounds	8-Hour TWA (ppmv)	Acceptable Ceiling Concentration (ppmv)	Acceptable Maximum Peak Above the Acceptable Ceiling Concentration for an 8-Hour Shift	
			Concentration (ppmv)	Maximum Duration
Benzene	10	25	50	10 minutes
Carbon Tetrachloride	10	25	200	5 minutes in any 4 hours
Ethylene Dibromide	20	30	50	5 minutes
Ethylene Dichloride	50	100	200	5 minutes in any 3 hours
Tetrachloroethene	100	200	300	5 minutes in any 3 hours
Trichloroethene	100	200	300	5 minutes in any 2 hours
Methylene Chloride	12.5	25	125	15 minutes
Vinyl Chloride	0.5	1	5	15 minutes
Methyl Chloroform	350	--	--	--
Chloroform	50	50	--	--

Notes:

OSHA Occupational Safety and Health Administration

ppmv Parts per million by volume in air

TWA Time weighted average

APPENDIX F
APPROVED LABORATORIES

TABLE F-1: TETRA TECH EM INC.-APPROVED LABORATORIES UNDER BASIC ORDERING AGREEMENT

Tidal Area Landfill (Site 1), Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Air Toxics, Ltd.	
Lab Address:	180 Blue Ravine Road, Suite B Folsom, CA 95630
Point of Contact:	Taryn Badal/Jennifer Miller
Phone:	(800) 985-5955
Fax:	(916) 985-1020
Business Size:	Large business (LB)
E-mail	T.Baldal@airtoxics.com J.Miller@airtoxics.com

Columbia Analytical Services	
Lab Address:	2665 Park Center Drive, Suite D Simi Valley, CA 93065
Point of Contact:	Kate Aguilera/Nicole DeMorin
Phone:	(805) 526-7161
Fax:	(805) 526-7270
Business Size:	LB
E-mail	ndemorin@simi.caslab.com

APPENDIX G
BORING LOGS

MONTGOMERY WATSON	365 Lennon Lane, Walnut Creek, California 94598, (510) 975-3400	CLIENT: CONCORD WPNSTA	PROJECT NUMBER: CTO 281	LOCATION: TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **TLSSB001**

Coordinates: Tidal Area Landfill

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 7/31/95	DATE 7/31/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–1	0.4	ML		Clayey SILT, 10YR4/2, weak to moderate structure, medium stiff, poor gradation, moist, low plasticity, few pores and paths in between small roots, majority fines, wood pieces, metal	marsh sediment overlying landfill sediment
1–4.5		ML		SILT, 10YR2/1, weak structure, soft, poor gradation, wet, low plasticity, many pores and paths in between roots, majority fines	marsh/surface sediment
4.5–7		CH		Fat Silty CLAY, 5Y4/1, 5Y3/1, strong structure, very stiff, poor gradation, moist, high plasticity, no pores and paths, majority fines, peat	marsh/surface sediment
7				End of Boring at 7.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12738 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: TLSSB002

Coordinates: Tidal Area Landfill

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 7/31/95	DATE 7/31/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–5	0.2	ML		SILT, 10YR2/1, weak structure, soft, poor gradation, moist to wet, low plasticity, few pores and paths in between small roots, majority fines, wood pieces, peat; organic odor	marsh sediment overlying landfill sediment
5				End of Boring at 5.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 7/31/95	DATE 7/31/95

LOG OF SOIL BORING: TLSSB003

Coordinates: Tidal Area Landfill

SURFACE CONDITIONS: pickle weed

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	Description	FEATURES/REMARKS
0–1	0.7	ML		SILT, 2.5Y3/2, weak structure, soft, poor gradation, damp, low plasticity, many pores and paths in between roots, peat, majority fines, wood pieces, peat; organic odor	marsh sediment overlying landfill sediment
1–7		ML		Clayey SILT, 10YR2/1, 10YR3/2, weak to moderate structure, medium stiff, poor gradation, moist, low plasticity, few pores and paths in between peat, majority fines, peat; organic odor	marsh/surface landfill sediment
7				End of Boring at 7.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12738 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **TLSSB004**

Coordinates: Tidal Area Landfill

					START	FINISH
Water Level						
Time					TIME	TIME
Date					DATE 7/31/95	DATE 7/31/95

SURFACE CONDITIONS: no vegetation

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	0.7	ML		SILT, 7.5YR3/1, weak structure, soft, poor gradation, moist, low plasticity, many pores and paths in between roots, majority fines, metal, evaporite deposits	marsh surface overlying landfill sediment
		ML		Clayey SILT, 10YR3/2, weak to moderate structure, medium stiff, poor gradation, moist, low to medium plasticity, few pores and paths in between peat, majority fines, peat material; organic odor	marsh surface overlying landfill sediment
1		ML		SILT, 10YR2/1, weak structure, soft, poor gradation, moist to wet, low plasticity, few pores and paths in between peat, roots, majority fines, peat material; organic odor	
7				End of Boring at 7.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12736 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **TLSSB005**

Coordinates: Tidal Area Landfill

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 8/1/95	DATE 8/1/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	0.5	ML		SILT, 10YR3/2, weak structure, soft, poor gradation, moist, low plasticity, many pores and paths in between roots, loose soil, majority fines, creosote soaked logs, metal scraps	marsh sediment overlying landfill sediment
		CL			marsh/surface landfill sediment
1		ML		Silty CLAY, 2.5Y4/2, moderate structure, medium stiff, poor gradation, moist, medium plasticity, few pores and pathes in between loose soil, rootlets, majority fines	marsh/surface landfill sediment
2				SILT, 7.5YR3/1, weak structure, soft, poor gradation, moist, low plasticity, few pores and pathes, in between loose soil, majority fines	
4		CL		Silty CLAY, 10YR3/2, moderate structure, medium stiff, poor gradation, moist, medium plasticity, few pores and pathes in between peat, majority fines, peat material; strong sulfur odor	marsh/surface landfill sediment
7				End of Boring at 7.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12738 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/1/95	DATE 8/1/95

LOG OF SOIL BORING: **TLSSB006**

Coordinates: Tidal Area Landfill

SURFACE CONDITIONS: sparse grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	DESCRIPTION	FEATURES/REMARKS
0	1.0	ML	SILT, jet black, weak structure, very soft, poor gradation, wet, low plasticity, few pores and paths in between roots, majority fines, jet black organic matter; organic odor	marsh sediment overlying landfill sediment
		GC	Clayey Sandy GRAVELS, SANDSTONE, 10YR4/4, weak structure, loose, poor gradation, wet, low plasticity, many pores and paths in between gravels, loose, rocky soil, 40% fines, gravels, gravels up to 2" in diameter	landfill sediment/gravels from nearby road
		CH	Fat Silty CLAY, 5Y3/1, moderate to strong structure, stiff, poor gradation, moist, high plasticity, few pores and paths in between peat, majority fines, peat material	emplaced soil
6			End of Boring at 6.0 ft	

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12736 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/1/95	DATE 8/1/95

LOG OF SOIL BORING: **TLSSB007**

Coordinates: Tidal Area Landfill

SURFACE CONDITIONS: pickle weed

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG		FEATURES/REMARKS
0.0–0.5	0.0	ML		Clayey SILT, 2.5Y3/1, weak structure, soft, poor gradation, moist, medium plasticity, many pores and paths in between roots, branches, majority fines, wood, white natural deposits in the soil	marsh sediment overlying landfill sediment
0.5–5.0		ML		SILT, 2.5Y2.5/1, 10YR2/1, weak structure, soft, poor gradation, damp, low plasticity, many pores and paths in between rootlets, roots, majority fines, peat material at 4' bgs; organic odor	marsh/surface landfill sediment
5.0				End of Boring at 5.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

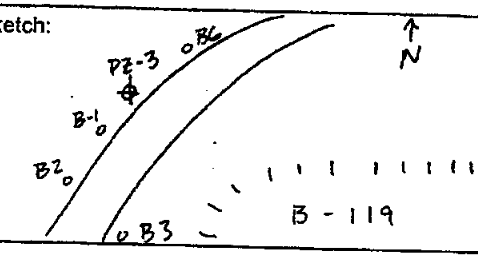
12738 ID: WALNUT1

TETRA TECH EM INC.

SOIL BORING AND WELL INSTALLATION LOG

CTO: 044-0281
Bldg./Site:
Project: Concord Tidal Area

Boring Number: PZ3	Date Started/Completed: 9/29/97
Drilling Method: Hollow stem auger, continuous sampling	Location Sketch:
Outer Diameter of Boring: 10"	
Inner Diameter of Well Casing 4"	
Depth to Water (ft. bgs., date) 6.6, 10/3/97	
Driller: Woodward Drilling, Rio Vista, CA	
Logged By: Rik Lantz, R.G.	



Piezometer PZ3

Lithologic Description

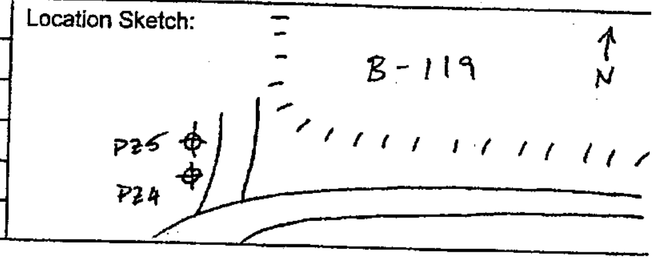
Depth (ft) bgs	Sample Number	Drive Interval/ Recovered Interval	Blow Count (per 6 inches)	Lithologic Description	USCS Soil Symbol	Well Construction	OVM (ppm)
0				GRAVEL, Coarse, with sand and silt	GM		
2		24/0	11/17/20/19	No sample recovery, 2-6'			0
4		24/0	4/6/5/3				0
6		24/20	2/1/1/2	SILTY SAND, loose brown, fine to medium, micaceous	SM	▼	0
7				SILTY CLAY, soft, black, with abundant organics and peat lenses	C		
8		24/22	1/2/2/5	SILTY SAND, Loose, brown, fine to medium	SM		0
9				SILTY CLAY, stiff, gray, with rare organic material	C		
10							

TETRA TECH EM INC.

SOIL BORING AND WELL INSTALLATION LOG

CTO:
Bldg./Site:
Project:

Boring Number: PZ4	Date Started/Completed: 9/29/97
Drilling Method: Hollow stem auger, continuous sampling	Location Sketch:
Outer Diameter of Boring: 10"	
Inner Diameter of Well Casing: 4"	
Depth to Water (ft. bgs., date) 6.4, 10/3/97	
Driller: Woodward Drilling, Rio Vista, CA	
Logged By: Rik Lantz, R.G.	



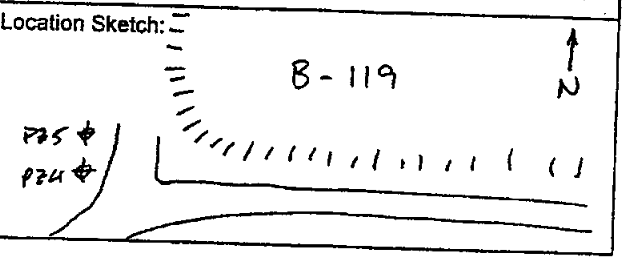
Depth (ft) bgs	Sample Number	Drive Interval/ Recovered Interval	Blow Count (per 6 inches)	Piezometer PZ4 Lithologic Description	USCS Soil Symbol	Well Construction	OVM (ppm)
0–2				GRAVEL, coarse, with fine sand and silt matrix	GM		
2–3				SILTY SAND, light tan, fine	SM		
3				SILTY CLAY, brown, mottled, fine	C		
4		24/12	2/3/2/3	SAND, brown, moist, medium	SP		
5				GRAVEL, gray, fine, rounded	GP		0
6		24/18	3/3/4/5	SILTY CLAY, dark gray, plastic, moist becomes mottled with root holes	C		
7							0
8		24/20	3/4/5/7	Greenish hue on separation surfaces			
9–10				SILTY CLAY, greenish gray, mottled, stiff with light tan irregular dry silty zones	C		0

TETRA TECH EM INC.

SOIL BORING AND WELL INSTALLATION LOG

CTO:
Bldg./Site:
Project:

Boring Number: PZ5	Date Started/Completed: 9/29/97
Drilling Method: Hollow stem auger, continuous sampling	Location Sketch:
Outer Diameter of Boring: 10"	
Inner Diameter of Well Casing: 4"	
Depth to Water (ft. bgs., date) 8.5 (rising), 10/15/97	
Driller: Woodward Drilling, Rio Vista, CA	
Logged By: Rik Lantz, R.G.	



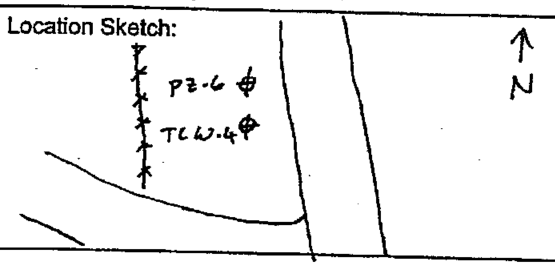
Piezometer PZ5

Depth (ft) bgs	Sample Number	Drive Interval/ Recovered Interval	Blow Count (per 6 inches)	Lithologic Description	USCS Soil Symbol	Well Construction	OVM (ppm)
0–2				GRAVEL, coarse, with fine sand and silt matrix	GM		
2–3				SILTY SAND, light tan, fine	SM		
3				SILTY CLAY, brown, mottled, fine	C		
4		24/12	2/3/2/3	SAND, brown, moist, medium	SP		
5				GRAVEL, gray, fine, rounded	GP		0
6–7		24/18	3/3/4/5	SILTY CLAY, dark gray, plastic, moist becomes mottled with root holes	C		0
8		24/20	3/4/5/7	Greenish hue on separation surfaces			
9–10				SILTY CLAY, greenish gray, mottled, stiff with light tan irregular dry silty zones	C		0

TETRA TECH EM INC. **SOIL BORING AND WELL INSTALLATION LOG**

CTO:
Bldg./Site:
Project:

Boring Number: B8 (PZ-6)	Date Started/Completed: 10/2/97
Drilling Method: Hollow stem auger, continuous sampling	Location Sketch:
Outer Diameter of Boring: 10"	
Inner Diameter of Well Casing 4":	
Depth to Water (ft. bgs., date) 7.0, 10/3/97	
Driller: Woodward Drilling, Rio Vista, CA	
Logged By: Rik Lantz, R.G.	



Piezometer PZ-6

Lithologic Description

Depth (ft) bgs	Sample Number	Drive Interval/ Recovered Interval	Blow Count (per 6 inches)	Lithologic Description	USCS Soil Symbol	Well Construction	OVM (ppm)
0				SILTY CLAY, brown, dry	C		
1							
2		24/10	7/10/15/14	SILTY CLAY, dark gray, very stiff, with irregular sand bodies	C		0
3							
				SILTY SAND, tan fine	SW		
4		24/6	4/5/7/6	SILTY CLAY, dark gray, moist	C		0
5							
6		24/24	3/4/6/8	SILTY CLAY, medium brown, stiff, moist, uniform	C		0
7						▼	
8		24/24	3/5/7/13	Same, with fine sandy zones			0
9							
10				Becomes soft			

Piezometer PZ-6

Depth (ft) bgs	Sample Number	Drive Interval/ Recovered Interval	Blow Count (per 6 inches)	Lithologic Description	USCS Soil Symbol	Well Construction	OVM (ppm)
		24/20	4/5/6/7	CLAYEY SILT, tan, very stiff, wet	ML		0
25							
26				Total Depth = 26'			

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 8/3/95	DATE 8/3/95

LOG OF SOIL BORING: RADSBB04

Coordinates: R Area Disposal Site

SURFACE CONDITIONS: sluice

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–2	2.4	ML		Clayey SILT, 10YR3/1, weak structure, soft, poor gradation, wet, low plasticity, many pores and paths, saturated sediment, majority fines, metal ammunition casing	former wetlands/surface sediment
2–6		ML		SILT, 2.5Y3/1, weak structure, very soft, poor gradation, moist, very low plasticity, many pores and paths in peat, roots, majority fines, decayed organic odor; peat material	former wetlands sediment
6				End of Boring at 6.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12736 ID: WALNUT1

MONTGOMERY WATSON	365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT: CONCORD WPNSTA	PROJECT NUMBER: CTO 281	LOCATION: TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **RADSBD06**

Coordinates: R Area Disposal Site

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/4/95	DATE 8/4/95

SURFACE CONDITIONS: pickle weed

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	4.0	CL		Silty CLAY, 10YR4/3, moderate structure, stiff, poor gradation, damp, low plasticity, few pores and paths in between small roots, cracked sediment, majority fines, pickle weed	surface sediment overlying former wetlands sediment
4		CH		Fat Silty CLAY, 5Y4/1, moderate structure, very stiff, poor gradation, damp, high plasticity, no pores and paths, majority fines, peat material	(emplaced soil)
7				End of Boring at 7.0 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12736 ID: WALNUT1

MONTGOMERY WATSON
365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 8/23/95	DATE 8/23/95

LOG OF SOIL BORING: **RADSBG04**

Coordinates: R Area Disposal Site

SURFACE CONDITIONS: dry grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	0.0	ML		Clayey SILT, 2.5Y5/3, weak structure, soft, poor gradation, damp, low plasticity, few pores and paths in between peat particles, majority fines, fill material in square patch along pipeline, peat material; decayed with iron/orange staining	fill material placed along a square patch
1		ML		SILT, 2.5Y2.5/1, weak structure, very soft, poor gradation, moist, low to non plastic, few pores and paths in between peat, majority fines, peat material; slight organic odor	former wetlands sediment
2.5		CL		Silty CLAY, 2.5Y4/1, moderate structure, medium stiff, poor gradation, moist, medium plasticity, few pores and paths in between peat, majority fines, peat material; organic odor	former wetlands sediment (emplaced)
8		CH		Fat CLAY, moderate to strong structure, medium stiff, poor gradation, moist, high plasticity, few pores and paths in between peat, majority fines, peat material	emplaced soil (bay mud)
				End of Boring at 8.1 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

\2736 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/21/95	DATE 8/21/95

LOG OF SOIL BORING: **RADSBG08**

Coordinates: R Area Disposal Site

SURFACE CONDITIONS: berm area

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	DESCRIPTION	FEATURES/REMARKS
0	0.8	CL	Silty Sandy CLAY with Gravel, 10YR3/1, weak structure, soft, poor gradation, dry/damp, low plasticity, many pores and paths in between gravels, majority fines, fill material; steel	fill material from berm area that separates sluice and former ephemeral pond
		CL	Silty CLAY, 2.5Y4/2, moderate structure, stiff, poor gradation, damp, medium plasticity, few pores and paths in between small roots, majority fines, fill material	fill material from berm area that separates sluice and former ephemeral pond
		ML	SILT, 10YR2/2, weak structure, soft, poor gradation, damp/moist, low plasticity, few pores and paths in between peat, roots, loose sediment, majority fines, possible reddish brick or clay material, strong sulfur smell	former wetlands sediment
4	1.7			
7			End of Boring at 7.0 ft	

12736 ID: WALNUT1

MONTGOMERY WATSON	365 Lennon Lane, Walnut Creek, California 94598, (510) 975-3400	CLIENT: CONCORD WPNSTA	PROJECT NUMBER: CTO 281	LOCATION: TIDAL AREA
		DRILLING AND SAMPLING METHODS: Hand Geoprobe		

LOG OF SOIL BORING: RADSBJ02

Coordinates: R Area Disposal Site

				START	FINISH
Water Level					
Time				TIME	TIME
Date				DATE 8/23/95	DATE 8/23/95

SURFACE CONDITIONS: fill material from railroad

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	DESCRIPTION	FEATURES/REMARKS
0–1.5	0.5	SM	Fine Silty SAND, 2.5Y4/4, weak structure, medium dense, poor gradation, damp, nonplastic, many pores and paths in between sand, 15% fines, sand fill material; wood	fill material from surrounding railroad berms
		SW	Medium to Coarse SAND, Mica, 2.5Y4/4, weak structure, loose, well gradation, damp, nonplastic, many pores and paths in between sand, 10% fines, sand fill material	fill material from surrounding railroad berms
		CL	Silty CLAY, 10YR5/3, strong structure, stiff, poor gradation, moist, medium to high plasticity, no pores and paths, majority fines	fill material from surrounding railroad berms
		ML	SILT, 10YR2/1, weak structure, very soft, poor gradation, moist, low plasticity, many pores and paths in between rootlets, majority fines, peat material	former wetlands sediment
		CH	Fat CLAY, GLEY4/5GY, GLEY4/10GY, strong structure, very stiff, poor gradation, moist, high plasticity, few pores and paths in between rootlets, majority fines, peat material	emplaced soil (bay mud)
7			End of Boring at 7.0 ft	

12738 ID: WALNUT1

MONTGOMERY WATSON

365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/11/95	DATE 8/11/95

LOG OF SOIL BORING: **WHSSBC02**

Coordinates: Wood Hogger Site

SURFACE CONDITIONS: pickle weed/grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–10	0.0	ML		SILT, 10YR3/2, weak structure, very soft, poor gradation, wet, low plasticity, many pores and paths in between peat, majority fines, peat material; sample collected in 1' of water	intertidal marsh area sediment

12738 ID: WALNUT1

Depth					Description	
					SILT continued	
11						
12					End of Boring at 12.0 ft	
13						
14						
15						
16						
17						
18						
19						
20						
21						

MONTGOMERY WATSON
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(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **WHSSBD03**

Coordinates: Wood Hogger Site

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 7/25/95	DATE 7/26/95

SURFACE CONDITIONS: pickle weed/grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	2.3	ML		Clayey SILT with Sand, 10YR2/1, weak structure, very soft, poor gradation, wet, low plasticity, few pores and paths in between peat, majority fines, large wood pieces at surface, mild to strong sulfur odor	intertidal marsh/surface sediment
1		ML		Clayey SILT, 10YR2/1, weak structure, very soft, poor gradation, wet, low plasticity, few pores and paths in between peat, majority fines, very strong sulfur odor from 4'-15', mild odor from 0'-4'	intertidal marsh/surface sediment
2					
3					
4					
5					
6					
7					
8					
9					
10					

MONTGOMERY WATSON
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CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

LOG OF SOIL BORING: **WHSSBD03**

Depth	Description
	Clayey SILT continued
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	End of Boring at 20.0 ft
21	

12738 ID: WALNUT1

MONTGOMERY WATSON 365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT CONCORD WPNSTA	PROJECT NUMBER CTO 281	LOCATION TIDAL AREA
	DRILLING AND SAMPLING METHODS: Hand Geoprobe		

LOG OF SOIL BORING: **WHSSBD07**

Coordinates: Wood Hogger Site

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 7/18/95	DATE 7/18/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	167.0	SM		Silty SAND and GRAVEL, 10YR3/2, weak structure, very loose, poor gradation, dry, nonplastic, many pores and paths, pore spaces between sediment and grass, 20% fines, fine grained wood chips	wood chips and sediment from former wood hogger
1.5		FILL		Large Pieces of WOOD Chips, 10YR2.5/1, weak structure, very loose, poor gradation, damp, nonplastic, many pores and paths, pore spaces between wood chips and gravels, 10% fines, fine to pebble sized wood chips	wood chips and sediment from former former wood hogger
2.3		CL		Sandy CLAY with Gravel, Quartz, 5Y3/1, 7.5YR5/6, moderate structure, medium stiff, poor gradation, moist, medium plasticity, many pores and paths, pore spaces between gravels, majority fines, hydrocarbon odor	(road base) with underlying clay
4		SW/SC		Well Graded SAND with Silt and Gravel, 5Y5/3, weak structure, very loose, moderate gradation, wet, low plasticity, many pores and paths between gravels and sand, 20% Fines	(road base) with underlying clay
4.4		CL		Sandy CLAY with Gravel, 10YR5/4, 5Y4/1, moderate structure, stiff, poor gradation, moist, medium plasticity, few pores and paths in between large gravels, majority fines, hydrocarbon odor	(road base) with underlying clay
7		GW/GM		Well Graded GRAVEL with Silt and Sand, 10YR5/4, weak structure, very loose, moderate gradation, wet, nonplastic, many pores and paths in between gravels, 20% fines	(road base)
7.5		CL		Sandy CLAY with Gravel, 10YR5/3, strong structure, stiff, poor gradation, moist to wet, medium to high plasticity, few pores and paths in between some gravels, majority fines, hydrocarbon odor	fill material to elevate area around Wood Hogger
10				End of Boring at 10.0 ft	

MONTGOMERY WATSON

365 Lennon Lane
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CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/25/95	DATE 8/25/95

LOG OF SOIL BORING: **WHSSBE08**

Coordinates: Wood Hogger Site

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–2	0.4	ML		Clayey SILT, 10YR4/2, 10YR3/1, weak structure, soft, poor gradation, moist, low plasticity, many pores and paths in between loose sediment, wood, majority fines, fill material; wood chips, very soft sediment	fill material to build up foundation around old Wood Hogger
2–3		FILL		WOOD/CONCRETE, 10YR3/1, strong structure, very dense, moist, nonplastic, many pores and paths, through wood, 0% fines, fill material; wood; concrete	fill material as boards used to lay and flatten area prior to placing fill material on top
3–9		SC/SM		Silty Clayey SAND, 5Y4/1, weak structure, loose, well gradation, wet, low plasticity, many pores and paths in between sand, 20% fines, fill material	fill material to build up foundation around old Wo-- Hogger
9–10		ML		Clayey SILT, 10YR3/1, weak structure, medium stiff, poor gradation, wet, low to medium plasticity, few pores and paths in between peat, majority fines, peat material; H2S odor; becomes clayier with depth	former wetlands/intertidal sediment

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365 Lennon Lane
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CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

LOG OF SOIL BORING: **WHSSBE08**

Clayey SILT continued

11

End of Boring at 11.0 ft

12

13

14

15

16

17

18

19

20

21

12738 ID: WALNUT1

MONTGOMERY WATSON	365 Lennon Lane, Walnut Creek, California 94598, (510) 975-3400	CLIENT: CONCORD WPNSTA	PROJECT NUMBER: CTO 281	LOCATION: TIDAL AREA
		DRILLING AND SAMPLING METHODS: Hand Geoprobe		

LOG OF SOIL BORING: **WHSSBF03**

Coordinates: Wood Hogger Site

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 7/25/95	DATE 7/25/95

SURFACE CONDITIONS: sand

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	1.5	CL		Sandy CLAY with Gravel, 2.5 Y4/3, weak structure, very soft, poor gradation, wet, medium plasticity, few pores/paths in between gravels and sand, majority fines, 20% coarse, wood & metals, sample located near rusting metal containers	intertidal marsh/surface sediment
0.5		CL		Sandy CLAY, 10YR4/4, 5Y4/2, strong structure, very hard, poor gradation, damp, low plasticity, no pores/paths, majority fines, 35% coarse	compacted clay marsh sediment
1.5	2.0				
2				Not Recorded	
4.5		CL/CH		Fat, Silty CLAY, 10YR3/1,5Y2.5/1, moderate structure, stiff, poor gradation, wet, high plasticity, few pores/paths in between peat, majority	intertidal marsh/ emplace
10					

12738 ID: WALNUT1

MONTGOMERY WATSON
365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

LOG OF SOIL BORING: **WHSSBF03**

Fat, Silty CLAY continued

11

End of Boring at 11.0 ft

12

13

14

15

16

17

18

19

20

21

\2738 ID: WALNUT1

MONTGOMERY WATSON
365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Geoprobe

Water Level				START	FINISH
Time				TIME	TIME
Date				DATE 8/25/95	DATE 8/25/95

LOG OF SOIL BORING: **WHSSBG06**

Coordinates: Wood Hogger Site

SURFACE CONDITIONS: wood debris

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	1.0	ML		Compacted SILT with Gravel, 2.5Y4/3, weak structure, stiff, poor gradation, dry, low plasticity, many pores and paths in between loose sediment, majority fines, gravels, fill material, wood	fill material from former debris dumpage area
		CL		Silty CLAY, 2.5Y4/2, moderate structure, stiff, poor gradation, damp, low plasticity, no pores and paths, majority fines, fill material; wood chips	fill material from former debris dumpage area
1	9.3	GP/SP		GRAVELS and Coarse SAND, GLEY4/10Y weak structure, loose, poor gradation, wet, nonplastic, many pores and paths in between gravels, 15% Fines, fill material	fill material from former debris dumpage area
2		CL		Sandy CLAY, 5Y4/1, 5Y3/1, moderate to strong structure, stiff, poor gradation, moist, medium plasticity few pores and paths in between sand, majority fines, fill material	fill material from former debris dumpage area
3					
4					
5					
6					
7		ML		SILT, 10YR2/1, weak structure, soft, poor gradation, moist, low plasticity, many pores and paths in between peat, loose sediment, majority fines, peat material; strong H2S odor	former wetlands/intertidal sediment
8					
9					
10					

12738 ID: WALNUT1

MONTGOMERY WATSON
365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

LOG OF SOIL BORING: WHSSBG06

Depth	Description
	SILT continued
11	End of Boring at 11.0 ft
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

MONTGOMERY WATSON	365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT CONCORD WPNSTA	PROJECT NUMBER CTO 281	LOCATION TIDAL AREA
		DRILLING AND SAMPLING METHODS Geoprobe		

LOG OF SOIL BORING: WHSSBH07

Coordinates: Wood Hogger Site

					START	FINISH
Water Level						
Time					TIME	TIME
Date					DATE 8/24/95	DATE 8/24/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–1	0.8	CL		Sandy CLAY with Gravel, 10YR4/2, 10YR5/4, moderate structure, medium stiff, poor gradation, moist, medium plasticity, many pores & paths in between sand, gravels, saturated sediment, majority fines, gravels, wood pieces, fill material, gw at 1' bgs; sweet odor	fill material overlying former wood dumpage
1–2.3		WOOD		WOOD, weak structure, loose, poor gradation, wet, nonplastic, many pores and paths in between wood, 0% fines, wood chunks, wood	wood and wood chips
2.3–3.5		FILL		DEBRIS; wood, concrete, 10YR4/6, weak structure, dense, damp to wet, nonplastic, many pores and paths in between wood, through soaked wood, 0% fines, wood pieces, concrete over 1' in thickness, refusal at 1' due to large wood pieces and concrete	wood dumpage and concrete material; fill material
3.5–9.5	1.3	ML		SILT, 2.5Y3/1, weak structure, very soft, poor gradation, moist, low plasticity, few pores and paths in between rootlets, loose sediment, saturated, majority fines, some peat; strong organic odor	former intertidal/wetlanc sediment
				End of Boring at 9.5 ft	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12738 ID: WALNUT1

MONTGOMERY WATSON
365 Lennon Lane
Walnut Creek,
California 94598
(510) 975-3400

CLIENT	PROJECT NUMBER	LOCATION
CONCORD WPNSTA	CTO 281	TIDAL AREA

DRILLING AND SAMPLING METHODS: Hand Geoprobe

LOG OF SOIL BORING: **WHSSBK06**

Coordinates: Wood Hogger Site

					START	FINISH
Water Level						
Time					TIME	TIME
Date					DATE 7/20/95	DATE 7/20/95

SURFACE CONDITIONS: grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0	0.0	ML		Sandy SILT with Gravels, 10YR2/2, weak structure, very soft, poor gradation, damp, low plasticity, few pores and paths in and around large gravels, majority fines, wood chips/gravels	surface sediment with gravel base from FAA tower
		CL		Sandy CLAY, 10YR4/2, moderate structure, soft, poor gradation, moist, medium plasticity, no pores and paths, majority fines	fill material to build up slightly higher elevation for tower
		CL		Silty CLAY, 10YR3/2, strong structure, soft, poor gradation, moist, high plasticity, no pores and paths, majority fines	fine clays to build up slightly higher elvation for tower
		FILL		Decayed WOOD, 10YR3/1, weak structure, soft, wet, nonplastic, many pores and paths in between wood chunks, 10% Fines, Wood, Decayed Wood	stacked wood that decayed; soil placed on top of wood
		CL		Sandy CLAY, 10YR2/2, weak structure, very soft, poor gradation, wet, low plasticity, few pores and paths in between sand, majority fines, wood chips	fill material from FAA tower
		CL		Sandy CLAY, 5Y3/1, moderate structure, medium stiff, poor gradation, wet, medium plasticity, no pores and paths, majority fines, peat	surface sediment/marsh sediment
10				End of Boring at 10.0 ft	

12730 ID: WALNUT1

MONTGOMERY WATSON 365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT CONCORD WPNSTA	PROJECT NUMBER CTO 281	LOCATION TIDAL AREA
	DRILLING AND SAMPLING METHODS: Hand Geoprobe		

LOG OF SOIL BORING: WHSSBL03					START	FINISH
Coordinates: Wood Hogger Site	Water Level					
	Time				TIME	TIME
	Date				DATE 7/21/95	DATE 7/21/95

SURFACE CONDITIONS: road base

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–1.7	1.9	SC		Clayey SAND with Gravels, 10YR5/4, strong structure, hard, poor gradation, dry, low plasticity, many pores and paths in between sand and gravels, 30% fines, gravel base to rail road tracks, wood, hillside leading to rail road tracks	road base fill material
1.7–4		CL		Sandy CLAY, 10YR5/6, moderate structure, stiff, poor gradation, moist to very moist, low plasticity, no pores and paths, majority fines	road base fill material
4–6		GW		Well Graded GRAVELS with Clayey Sand, Quartz, 10YR5/6, weak structure, dense, well gradation, wet, low plasticity, many pores and paths in between gravels, 15% fines	road base fill material
6–10		CL		Silty CLAY, 10YR3/1, moderate structure, stiff, poor gradation, moist, medium plasticity, few pores and paths in between peat roots, majority fines, methane odor; clay becomes stiffer with depth	intertidal marsh

End of Boring at 10.0 ft

MONTGOMERY WATSON 365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT CONCORD WPNSTA	PROJECT NUMBER CTO 281	LOCATION TIDAL AREA
	DRILLING AND SAMPLING METHODS: Hand Geoprobe		

LOG OF SOIL BORING: WHSSBM08	Water Level			START	FINISH
Coordinates: Wood Hogger Site	Time			TIME	TIME
	Date			DATE 7/28/95	DATE 7/28/95

SURFACE CONDITIONS: sparse grasses

GEOLOGIST: Y.LEUNG

DEPTH (ft)	PID (ppm)	USCS	GRAPHIC LOG	DESCRIPTION	FEATURES/REMARKS
0–1.7	0.4	CL		Sandy CLAY with Gravel, 5Y3/2, weak to moderate structure, medium stiff, poor gradation, wet, low plasticity, many pores and paths in between sand, gravels, majority fines, expended bullet casings, gravel road base, oil & reosote from overlying RR structure	intertidal marsh overlying former road base/layered fill w/intertidal surface sediment
1.7–3		GC		GRAVEL with Sandy Clay, 5Y5/3, weak structure, medium stiff, poor gradation, wet, low plasticity, many pores and paths in between gravels, 30% fines, gravel road base	road base fillmaterial underlying former road structure
3–4		CH		Fat Silty CLAY, 10YR4/2, GLEY3/10Y, strong structure, hard, poor gradation, damp, high plasticity, no pores and paths, majority fines, very compacted clays	possible compacted fill material underlying the road base gravels
4–7		CL		Silty CLAY with Sand, 5Y4/2, moderate structure, stiff, poor gradation, damp, medium plasticity, no pores and paths, majority fines	possible fill from former road/intertidal marsh sediment
7–9				Contact unknown sample unattainable	
9–10	2.3	ML		SILT, 10YR2/1, weak structure, soft, poor gradation, moist, low plasticity, many pores and paths in between peat and roots, majority fines, very strong sulfur odor	intertidal marsh sediment

\2738 ID: WALNUT1

MONTGOMERY WATSON	365 Lennon Lane Walnut Creek, California 94598 (510) 975-3400	CLIENT: CONCORD WPNSTA	PROJECT NUMBER: CTO 281	LOCATION: TIDAL AREA

LOG OF SOIL BORING: WHSSBM08

SILT continued

11

End of Boring at 11.0 ft

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PRC ENVIRONMENTAL MANAGEMENT, INC.

LOG OF GEOPROBE BORING
37-04

PROJECT: INLAND/TIDAL AREA SI	LOCATION: SWMU 37
PROJECT NO.: 044-0283	SURFACE ELEVATION: 2.46 ft. MSL
DATE DRILLED: 13-APR-95	DRILLING METHOD: GEOPROBE
LOGGED BY: R. Vernimen	DRILLING COMPANY: PRC EMI

ELEVATION (FEET) DEPTH	SAMPLE	SAMPLE NO.	PID (ppm)	BLOWS/FT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	CHEMICAL CONCENTRATIONS * (mg/kg) ▲ Diesel ■ Gasoline
		SS011	0.0	PUSH		GW	FILL (af) SILTY GRAVEL (GW), gray (5Y 5/1), angular to subrounded, well graded, damp, medium dense, with little fine-grained sand	
						ML	FILL (af) SANDY SILT (ML), light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6), mottled, low plasticity, very fine-grained sand, poorly graded, damp medium stiff	
		SS012	0.0	PUSH		GW	FILL (af) SILTY GRAVEL (GW), very dark gray (2.5Y 3/1), angular to subrounded, well graded, moist, dense, with little fine-grained sand	
						ML	FILL (af) GRAVELLY SILT (GW), yellowish brown (10YR 5/6), with dark gray (10YR 4/1) gravel, low plasticity, damp, stiff, with little sand Refusal @ 6 ft.	
10							T.D. of boring @ 6.0 feet	
20								
30								

* Field screening Analytical Results

SHEET: 1 of 1

PRC ENVIRONMENTAL MANAGEMENT, INC.

LOG OF GEOPROBE BORING
37-06

PROJECT: INLAND/TIDAL AREA SI	LOCATION: SWMU 37
PROJECT NO.: 044-0283	SURFACE ELEVATION: 5.92 ft. MSL
DATE DRILLED: 17-APR-95	DRILLING METHOD: GEOPROBE
LOGGED BY: R. Vernimen	DRILLING COMPANY: PRC EMI

ELEVATION (FEET) DEPTH	SAMPLE	SAMPLE NO.	PID (ppm)	BLOWS/FT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	CHEMICAL CONCENTRATIONS * (mg/kg) ▲ Diesel ■ Gasoline
		SS023	0.0	PUSH		SM	ASPHALT (~1 in.) over BASEROCK (~4 in.) COLLUVIUM (Qco) SILTY SAND (SM), yellowish brown (10YR 5/6), very fine-grained, poorly graded, damp, medium dense. Color changes to olive brown (2.5Y 4/4)	
		SS024	0.0	PUSH		SP	COLLUVIUM (Qco) SAND (SP), olive brown (2.5Y 4/4), fine-grained, poorly graded, wet, medium dense, with trace silt	
							T.D. of boring @ 7.0 feet	
10								
20								
30								

* Field screening Analytical Results

SHEET: 1 of 1

???(??)(???-????) ???????.DWG ??/??/?? PLOT 1=1 R001

APPENDIX H
CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD GUIDANCE

CIWMB GUIDANCE

F. How to Perform Monitoring

(1) At existing probes:

a. Check probe condition and structural integrity and suitability for monitoring. Be sure each probe monitored is not connected to any negative pressure source or vacuum. A simple way to check for negative pressure is to hold a sheet of paper just above the opening of the probe and see if the paper is sucked to the opening. If the paper is sucked to the probe opening, the probe is more than likely influenced by negative pressure. A magnehelix, if available, may also be used to determine whether or not a probe is under the influence of negative pressure. The magnehelix is a device that measures pressure in terms of inches of water. If the probe is influenced by negative pressure, then it should not be sampled with the CGI because the machine could be damaged by overworking to overcome the negative pressure, and it may not detect gas at the correct concentration, even if there is some being generated and migrating. Probes that are damaged or are under negative pressure are considered inadequate for monitoring.

b. Take a combustible gas indicator that is properly calibrated and warmed up open the petcock or otherwise ready the probe for sampling, and connect the flexible intake tube assembly to the probe, making sure that there is a tight seal. (Note: Prior to taking any reading allow the CGI to warm-up at least 5 minutes. This will stabilize the instrument and any internal gas-measurement detectors.) Instruments for Board staff are periodically calibrated according to the manufacturers specifications at the Board's field shop.

c. Probes should be sampled for LFG based upon the following criteria:
For probes 20 feet deep or less - let the CGI sample the gases directly from the probe until there is a steady reading for the LFG concentration on the dial for 30 seconds.

For probes more than 20 feet deep - at least one probe volume should be sampled (see calculation below). Use the accessory pump (AP) to evacuate one volume of the probe. After evacuating one probe volume connect the exhaust end tube of the AP to the intake valve of a completely empty tedlar bag. Fill the tedlar bag until there is a sufficient amount of volume to sample with the CGI. Disconnect the tube of the AP from the tedlar bag, and connect the CGI to the intake valve of the tedlar bag, sampling until there is a steady reading for the LFG concentration on the dial for 30 seconds.

Probe Volume and Evacuation Time Calculation:

$$Et = \frac{\Pi D^2 (\cancel{in.^2})}{4} * \frac{Pd (\cancel{ft.})}{} * \frac{\cancel{ft^2}}{144\ \cancel{in.}^2} * \frac{1}{\frac{Pr.\ \cancel{ft^3}}{\cancel{Hr.}}} * \frac{3600\ Sec}{\cancel{Hr.}} = \frac{19.6(D^2)(Pd)}{Pr.}$$

Where:

Et = Evacuation Time (sec.)
Π = 3.14
D = Probe Diameter (in.)
Pd = Probe Depth (ft.)
Pr = Pump rate of instrument (ft.^{3}/Hr.)

Example:

Given: A LFG probe with a diameter of 1/2 inch, and a depth of 30 feet. Using a Waste Board CGI (Pump Rate of approximately 3 ft.^{3} / Hr.), find the time required to Evacuate one probe volume.

Equation: $ET = \frac{19.6 * D^2 (in.) * Pd (ft.)}{Pr.}$

Solution: $\frac{19.6 * (0.5\ in^2.) * (30\ ft.)}{3.0} \cong \underline{50\ seconds}$

d. Record the steady reading, as well as any peak reading. The steady reading obtained will be the reading used to determine compliance with the gas control standards at that point.

It is suggested that for purposes of documentation of the monitoring results that a log be kept with each monitoring instrument to record the readings taken at probes where the monitor is used during each inspection. The instrument serial number, time of readings, and probe number site location should be noted. Additionally, there should be a separate form for each inspection that includes sampling date, time, weather conditions, name of inspector, equipment model and serial numbers, calibration information, and readings taken. The additional form should be placed in the facility file with the final approved inspection report.

APPENDIX I
RESPONSE TO REGULATORY AGENCY AND PUBLIC COMMENTS

RESPONSES TO AGENCY COMMENTS ON THE DRAFT LANDFILL GAS SAMPLING AND ANALYSIS PLAN, SITE 1 TIDAL AREA LANDFILL NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD CONCORD, CALIFORNIA

This document presents the U.S. Department of the Navy (Navy) responses to comments from the regulatory agencies on the "Draft Landfill Gas Sampling and Analysis Plan, Site 1 Tidal Area Landfill, Naval Weapons Station Seal Beach Detachment Concord, California, dated October 31, 2002." The comments addressed in the following document were received from the U.S. Environmental Protection Agency (EPA) on November 23, 2004, and the California Regional Water Quality Control Board (Water Board) on November 24, 2004.

Agency comments are presented in boldface type.

RESPONSE TO COMMENTS FROM EPA

EPA General Comment: **Based upon review of the Landfill Gas Sampling Plan, U.S. EPA has some comments and recommendations. Most of U.S. EPA's comments pertain to the purpose and the scope of the investigation and can be readily addressed by the Navy. One of U.S. EPA's more significant recommendations is that the Navy collect a minimum of eight (8) confirmation/supplemental volatile organic compound samples for laboratory analyses.**

Response: Please see response to EPA Specific Comment 3 for a more detailed explanation. The Navy will collect eight (8) confirmation / supplemental LFG samples for VOC analysis at an off-site laboratory.

SPECIFIC COMMENTS

1. **EPA Comment:** **<u>Section 1.1.2, Problem to be Solved (page 2); Section 2.1.1, Emissions Screening and Landfill Gas Sampling (page 28); and Figure 2, Site Plan</u>: U.S. EPA has some concern with the surface emissions sampling area as shown on Figure 2. While U.S. EPA is aware that the Navy (per Section 1.1.2) selected the central portion of the landfill as the surface sampling area to avoid areas of unstable soils that exist in other areas of the site, U.S. EPA does not believe this soil stability issue should prevent the Navy from surveying large portions of the site, in particular the western portions of the site that would have received waste later in the site's operational history than the central portion (U.S. EPA Program staff have walked large areas of the Site 1 landfill**

without injury and believe outer portions of the landfill should be included in the surface/subsurface survey). Also, in order to support the design of a gas collection/venting system, surface samples are needed near the landfill perimeter.

Response: The Navy will conduct surface emissions screening and sampling beyond the central portion of the landfill (shown on Figure 2) in order to get sufficient areal coverage. Large portions of the site, including western portions of the landfill and the landfill perimeter will be included in the screening and sampling.

Figure 2 has been revised in the Final SAP to reflect a wider proposed area for landfill gas sampling. Sections 1.1.2 and 2.1.1 has been revised to remove statements regarding the use of soil stability to determine LFG screening and sampling areas.

2. EPA Comment: **Section 1.1.2, Problem to be Solved (page 3): Regarding a landfill gas sampling schedule, text only indicates that a schedule has not been established. The Navy should indicate that the landfill gas sampling work and report (or technical memorandum) must be completed before a final Site 1 Remedial Design is produced (scheduled for March 4, 2005, per the October 1, 2004, Draft Final Site Management Plan).**

Response: The last sentence of paragraph 3 in Section 1.1.2 has been revised in the Final SAP to state: The results of surface emissions screening and sampling of subsurface gas monitoring probes has been discussed in a report to be completed before a final Site 1 Remedial Design is produced (scheduled for April 7, 2005, per the November 26, 2004, Draft Final Site Management Plan). Further, Table 2 – Implementation Schedule for Sampling, Analysis and Reporting has been revised in the Final SAP to reflect the completion of the report prior to finalizing the Site 1 Remedial Design.

3. EPA Comment: **Section 1.2.2, Project Measurements (page 9): Text indicates that based upon the surface screening results, an unknown number of additional samples will be collected and analyzed for VOCs and fixed gasses at an off-site laboratory. While the exact number of confirmation samples cannot be clearly identified, at a minimum, U.S. EPA requests that eight (8) gas samples be collected and analyzed for volatile organic compounds (VOCs) and fixed gas (please note that the primary focus of these 8 supplemental samples are VOCs; shallow soil gas samples similar to those collected last year at the Concord Solid Waste Management Units (SWMUs) sites would be acceptable).**

Response: Section 1.2.2 of the Final SAP has been revised to state that based on the surface screening results, eight (8) LFG samples will be collected and analyzed for VOCs and fixed gases at an off-site laboratory. The 8 samples will be collected from various locations within the landfill based on (1) locations of surface screening samples where the highest concentrations were detected and/or (2) representative sampling of the landfill (areal coverage).

4. **EPA Comment:** **<u>Table 3, Data Quality Objectives for Landfill Gas Characterization (page 11)</u>: Under "Step 1: State the Problem", the Navy indicates in the last sentence, "[s]ince the Tidal Area Landfill has not received waste since 1979, it is in the later stage of [landfill gas] generation, where methane concentrations are low." U.S. EPA recommends the following replacement sentence: *To date, the Navy has not collected data on methane, fixed gasses, and/or VOCs and therefore, the concentration of these gases are unknown*.**

Response: This sentence has been revised as requested.

5. **EPA Comment:** **<u>Table 3</u>: Under "Step 2: Identify the Decisions", text states, "[t]he primary decision to be made is whether landfill gas vents would be warranted in the final design of the cover." However, in Section 1.1.1, Purpose of the Investigation (page 2) text states, "[r]egardless of the results of the [landfill gas] survey, some amount of [landfill gas] venting would be included in the design of the cap." Consistent with past discussions, U.S. EPA agrees with the Navy' position as stated in Section 1.1.1, and recommends that the Navy correct the statement in Table 3.**

Response: The statement in Table 3 under "Step 2: Identify the Decisions" has been revised in the Final SAP to state that "The primary decision to be made concerns the amount of landfill gas venting warranted for the final design of the cover." Further, additional text has been added under Step 2 to reflect that decisions regarding the number and placement of LFG vents will be based on the results LFG screening and sampling data evaluation.

6. EPA Comment: **<u>Table 4: Data Quality Objective for Landfill Gas Perimeter Monitoring Probes</u>: The third sentence in paragraph number 2 under "Step 1: State the Problem", indicates, "[t]his event will be conducted to determine that methane concentrations do not exceed the lower explosive limit of 5 percent by volume...at the boundary and that trace gases do not pose a potential threat to health." Please restate the sentence to reflect an unbiased outcome of the sampling (i.e., *This event will be conducted to determine if methane concentrations exceed the lower explosive limit.. or to determine what the methane gas concentrations are relative to State regulatory standards*...).**

Response: The statement has been revised in the Final SAP as requested.

RESPONSE TO COMMENTS FROM WATER BOARD

SPECIFIC COMMENTS

1. Water Board Comment: **<u>Section 1.1.2, Problem to be Solved, p 2</u>:**

1a) The Navy needs to account for seasonality in the production of landfill gas. The production of these gaseous compounds is influenced by the fluctuation of the water table. Hence the Navy needs to consider sampling gases over 4 consecutive quarters to aid in the design of the landfill gas monitoring network.

1b) Please tabulate the regulatory driven concentrations limits for the gases that will be sampled.

Response:

1a) The Navy recognizes that the production of landfill gas (LFG) at the site may be influenced by the fluctuation of the water table as well as other factors, such as temperature. While the volume of LFG produced may fluctuate seasonally, the detection of LFG constituents within a given area is likely to remain constant. Seasonal monitoring data is not essential to designing a protective venting system for the landfill. The limited value added to the design of an LFG monitoring plan does not merit the time and resources required to collect and analyze four consecutive quarters of LFG data. Landfill vents can be designed to accommodate the fluctuation in the seasonal volume of landfill gas produced.

1b) The regulatory driven concentration limits are the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) provided in Table E-1 of the SAP. The title of Table E-1 has been changed to "Analytical Reporting and Regulatory Limits for Landfill Gas Samples" in the Final SAP. Not all LFG analytes tested under EPA Method TO-15, and listed in Table A-1, have a PEL.

2. Water Board Comment: **<u>Figure 2, Site Plan</u>:**

2a) Water Board staff recommends sampling landfill gases throughout the landfill perimeter. Water Board staff understands the safety contingency due to uneven grounds at the landfill. However, the Navy needs to make every effort to sampling all areas of the landfill to obtain a most representative dataset of field conditions. Solutions to this quandary involves for example: use of remote equipment, laying boards, temporarily securing uneven grounds, reaching these areas with amphibious technologies.

2b) Water Board staff recommends adding sampling locations on the western half of the landfill to improve the sampling grid resolution.

Response:

2a) The Navy will screen and sample in various locations of the landfill in order to get sufficient areal coverage. Also, please see the response to EPA Specific Comment 1.

2b) As stated for above and in response to EPA Specific Comment 1, the Navy will screen and sample in various locations of the landfill (including the western half) in order to get sufficient areal coverage.

3. Water Board Comment: **<u>Table 3, Data Quality Objectives for Landfill Gas Characterization, Step 2 p 11</u>: Reconcile the statement: "The primary decision to be made is whether landfill gas vents would be warranted in the final design of the cover." with the Site 1 ROD (Record of Decision) statement insuring that regardless of the monitoring results "some amount of landfill gas venting would be included in the design of the cap."**

Response: As stated in the Navy's response to EPA Specific Comment 5, the statement in Table 3 under "Step 2: Identify the Decisions" has been revised in the Final SAP to state that "The primary decision to be made concerns the amount of landfill gas venting warranted for the final design of the cover." This revision reflects that some amount of landfill gas venting would be included in the design of the cap. Further, additional text has been added under Step 2 to reflect that decisions regarding the number and placement of LFG vents will be based on the results LFG screening and sampling data evaluation.

4. **Water Board Comment:** **<u>Section 2.1.1, Emission Screening and Landfill Gas Sampling, p 28</u>:**

4a) Report the landfill gas concentrations in ppmv.

4b) Provide the basis for only proposing three landfill gas probes locations prior to the initial screening.

Response:

4a) July 2003 screens constituents in µg/m^3. All of our contract laboratories and the Navy's database for all Bay Area Navy sites list concentrations only in µg/m^3.

Some laboratories also report concentrations in parts per million by volume (ppmv). Conversion from µg/m^3 to requires calculation involving the molecular weight of the compound. Reporting in both formats would require more space on tables that are often already crowded and also requires an additional computational step. If the laboratory that runs the analysis reports in ppmv, and if space allows, the Navy will report in ppmv in addition to µg/m^3; otherwise results will be reported only in terms of µg/m^3.

4b) Three (3) subsurface gas monitoring probes placed along the eastern perimeter of the landfill will adequately detect migrating landfill gas. The three subsurface probes will be placed within 1,000 feet of each other per Title 27 *California Code of Regulations* (CCR) 20925 [b] and will be within California Integrated Waste Management Board (CIWMB) regulations for perimeter monitoring. No probes will be necessary on the western portion of the landfill because of the hydraulic barriers created by the waterways in these areas.

Given that a LFG migration pathway only exists along the eastern portion of the landfill, the number of subsurface perimeter probes is largely determined by the length of the perimeter to be monitored and the locations of nearby structures, if any, rather than by the results of the initial screening. The results of the initial screening will be used primarily to evaluate placement and number of landfill vents that will be required.

5. Water Board Comment: **<u>Section 2.1.2, Perimeter LFG Probe Installation and Limited Off-Site Gas Migration Testing, p 29</u>:**

5a) The Navy states that no probes will be necessary along the western portion of the landfill "because of the hydraulic barriers created by the waterways in these areas." Please clarify how this process is occurring. Also identify the conditions where the waterways might not act as a hydraulic barrier to gaseous migration. Clarify measures that will be taken for these conditions to never develop.

5b) Highlight how the "permanent low seasonal water table" will be computed.

Response:

5a) The northwestern, western, and southwestern boundaries of the landfill ("western portion") are adjacent to ponded water that occurs year-round. Consequently, water fills all of the pore space of soils along the western perimeter, creating a "hydraulic barrier" that is not conducive to the migration of landfill gas. Due to the high water table, at least a portion of the western landfill is inundated, which further reduces the possibility of landfill gas migrating to the western perimeter. Landfill gas will preferentially migrate through the more permeable materials located above the water table.

5b) The "permanent low seasonal water table" is not computed but will be determined from the historically lowest measured groundwater elevation measured from one of the monitoring wells along the eastern perimeter of the site (monitoring wells TLSMW003, TLSMW004, and TLSMW005, see Figure 4). The text of the Final SAP has been revised accordingly.